Part 6 Additional class notations

Chapter 7 Environmental protection and pollution control
FOREWORD

DNV GL rules for classification contain procedural and technical requirements related to obtaining and retaining a class certificate. The rules represent all requirements adopted by the Society as basis for classification.

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Any comments may be sent by e-mail to rules@dnvgl.com

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# CHANGES – CURRENT

This document supersedes the July 2018 edition of DNVGL-RU-SHIP Pt.6 Ch.7. Changes in this document are highlighted in red colour. However, if the changes involve a whole chapter, section or subsection, normally only the title will be in red colour.

## Changes July 2019, entering into force 1 January 2020

<table>
<thead>
<tr>
<th>Topic</th>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarification of rules for ballast water management (BWM)</td>
<td>Sec.1 [3.3.1.2]</td>
<td>Included steel actuators in the requirements for isolation valves on plastic pipes. Steel materials or materials with equivalent heat resistance are acceptable.</td>
</tr>
<tr>
<td></td>
<td>Sec.1 [3.3.3.5]</td>
<td>Requirement introduced to clarify rules for ventilation of compartment for BWMS installations.</td>
</tr>
<tr>
<td></td>
<td>Sec.1 Table 1</td>
<td>The required piping diagram is replaced by a pressure drop analysis to clarify what verifications are needed in cases where the flow-through method is used for ballast water exchange.</td>
</tr>
<tr>
<td></td>
<td>Sec.1 Table 2</td>
<td>Requirement on submission of documents in accordance with Pt.4 Ch.6 for ballast water management installations using ozone. Requirement on submission of documentation of design philosophy, in order to clarify if an ozone system is designed in accordance with Pt.4 Ch.6 Sec.7.</td>
</tr>
<tr>
<td></td>
<td>Sec.1 Table 2</td>
<td>Reduced documentation requirements for systems type approved by DNV GL.</td>
</tr>
<tr>
<td>Class notation Quiet</td>
<td>Sec.8</td>
<td>New class notation defining a standard measurement procedure for airborne emitted noise from ships.</td>
</tr>
<tr>
<td>Restructure and improvement of rules for emission reduction</td>
<td>Sec.7 [10.1.2]</td>
<td>New requirement for free standing tanks for hazardous chemicals.</td>
</tr>
<tr>
<td></td>
<td>Sec.7 [3.1.7]</td>
<td>NDT requirement and related guidance note is removed and relevant requirements for manufacture has replaced reference to Class III piping systems.</td>
</tr>
<tr>
<td></td>
<td>Sec.7 [4.1.2]</td>
<td>Introduces a more lenient requirement for EGCS units as packing beds are now allowed. SCR requirement is updated to remove the superfluous requirement on temperature control and add that SCR may also be operated at elevated temperature to avoid soot build up on catalyst.</td>
</tr>
<tr>
<td></td>
<td>Sec.7 [4.2.2]</td>
<td>Added that a single failure shall not override the interlock logic, in line with existing practice.</td>
</tr>
<tr>
<td></td>
<td>Sec.7 [4.3]</td>
<td>New requirements for blocking dampers (or valves) in multi inlet systems, in line with existing practice.</td>
</tr>
<tr>
<td></td>
<td>Sec.7 [6]</td>
<td>EGR section is updated with more guidance on the scope of EGR approval. Such systems shall in general comply with EGCS qualifier requirements as applicable for the type of system. Reference to EGR guideline is also added.</td>
</tr>
<tr>
<td>Topic</td>
<td>Reference</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
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<td>-------------</td>
</tr>
<tr>
<td><strong>Environmental protection and pollution control</strong></td>
<td><strong>Part 6 Chapter 7 Changes - current</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sec.7 [7.1]</strong></td>
<td>New guidance on application of special EGCS qualifiers.</td>
<td></td>
</tr>
<tr>
<td><strong>Sec.7 Table 1</strong></td>
<td>Added new qualifiers <strong>Enhanced</strong> and <strong>Zero discharge</strong>.</td>
<td></td>
</tr>
<tr>
<td><strong>Ballast water management</strong></td>
<td><strong>Sec.1 [1.5.2]</strong></td>
<td>Contingency measures has been introduced as a voluntary part of guideline G4 for the BWM plan.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.1 Table 2</strong></td>
<td>Added new qualifiers <strong>Enhanced</strong> and <strong>Zero discharge</strong>.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.1 [1.7]</strong></td>
<td>A biological compliance test shall be carried out in accordance with BWM.2/Circ.70 if required by the flag state. A sample point before the BWMS may be relevant.</td>
</tr>
<tr>
<td>**Restructuring rules for class notation <strong>Re cyclable</strong></td>
<td><strong>Sec.4 [2]</strong></td>
<td>Subsection for survey requirements has been moved to Pt.7 Ch.1 Sec.6 [35].</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.4 [3]</strong></td>
<td>Requirement on investigation of 15 hazardous materials, hazmat inspection method principles and usage of AoSS for hazmat expert companies is introduced.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.4</strong></td>
<td>Statutory requirements have been moved to DNVGL-SI-0289.</td>
</tr>
<tr>
<td><strong>Shore power notation</strong></td>
<td><strong>Sec.5 [1.1]</strong></td>
<td>Added objective of class notation <strong>Shore power</strong>.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.5 [1.2]</strong></td>
<td>Clarification added that operation characteristics are not covered and that class notation <strong>Shore power</strong> is not intended for shore connections used during service and maintenance docking.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.5 [1.3]</strong></td>
<td>Notation <strong>Shore power</strong> is made mandatory for high voltage shore connection and low voltage shore connection with power ratings greater than or equal to 1 MVA.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.5 [1.4]</strong></td>
<td>New subsection and table added with details concerning the class notation.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.5 [1.5]</strong></td>
<td>Added IEC/IEEE 80005-series to references.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.5 [1.6]</strong></td>
<td>New subsection with definitions and abbreviations.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.5 [1.7]</strong></td>
<td>Clarification of limitations of shore power supply.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.5 [1.8]</strong></td>
<td>Documentation requirements and certification requirements are re-organized for improved readability.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.5 [2.2]</strong></td>
<td>Clarification on installation requirements of shore connection switchboards.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.5 [2.3]</strong></td>
<td>Clarifications regarding emergency disconnection procedures, allowing manual operation of earthing switches.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.5 [2.4]</strong></td>
<td>New subsection describing ship-to-shore interconnection systems.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.5 [2.7]</strong></td>
<td>Added explanation with regard to scope and obligations for testing of the onboard shore power installation.</td>
</tr>
<tr>
<td></td>
<td><strong>Sec.5 Table 6</strong></td>
<td>New table defining component documentation requirements. Deletion of documentation requirements E210 and E100.</td>
</tr>
</tbody>
</table>
### Editorials corrections

In addition to the above-stated changes, editorial corrections may have been made.
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SECTION 1 BALLAST WATER MANAGEMENT - BWM

1 General

1.1 Introduction

The International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM) (hereafter called the Convention), entered into force on 2017-09-08. The Convention provides regulations to prevent transfer and introduction of harmful aquatic organisms and pathogens via ballast water. The requirements for the voluntary class notation BWM are in compliance with the Convention.

1.2 Objective

The objective of the class notation BWM, is to provide the Society's interpretation of the Convention and set requirements for ballast water management and installations of treatment systems onboard the vessel.

1.3 Scope

The class notation BWM specifies requirements for ballast water exchange and treatment system installations. Relevant procedural requirements are included for ships using ballast water in international trade and for which the Convention is applicable.

1.4 Application

The class notation BWM may be applied to ships of any type, operating in the aquatic environment. The requirements in [3.3] - [3.5] are applicable to all ships installing a ballast water management system.

1.5 Class notations

1.5.1 Ships complying with the requirements in this section may be given one of the following class notations, or a combination of the notations, as applicable:

- **BWM(E[m])** = ballast water exchange, where m denotes the method for exchange that has been applied and shall be replaced by the letters in as defined in [1.5.2].
- **BWM(T)** = ballast water treatment, see [1.5.3].

1.5.2 The class notation BWM(E[m]) is intended for ships operating in areas where ballast water exchange is accepted. The exchange of the ballast water may take place either by the sequential method, flow through method or the dilution method. The applied method is indicated by the letters in the bracket:

- **s** for sequential method
- **f** for flow-through method
- **d** for dilution method.

**Guidance note:**

It is recommended to obtain a procedure for ballast water exchange which can be applied as a contingency measure in cases where ballast water treatment is not possible. The vessel does not need a BWM(E[m]) notation, but should have an approved ballast water exchange method in the BWM plan.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
1.5.3 The class notation **BWM(T)** is intended for ships complying with the Convention by means of a type approved system for treatment of ballast water (by guideline G8 in the Convention or the BWMS Code).

1.6 Terminology and definitions
The definitions as stated in the Convention, its appendices and related IMO documents apply to these rules.

1.7 Onboard commissioning
For **BWM(T)**, a commissioning specific to the ballast water treatment system shall be carried out according to the Convention. The commissioning shall follow an approved commissioning procedure. If required by the flag administration, a biological compliance test shall also be carried out and a report shall be submitted in accordance with BWM.2/Circ.70.

**Guidance note:**
A biological compliance test report, when required, shall provide evidence, at least as assessed by indicative means, that the ballast water discharge shows D-2 compliance. The report including methods and detailed results shall be accepted by the attending surveyor at the initial survey.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

1.8 Sediment management
Sediment management shall follow the recommendations given in the guidelines to the Convention. The recommendations given in the annex of resolution MEPC.209(63) *2012 Guidelines on design and construction to facilitate sediment control on ships (G12)* shall be observed as far as practicable. Detailed sediment management procedures shall be included in the ballast water management plan.

**Guidance note:**
At least, manual sediment removal at installation if relevant and every 5 years during class renewal should be addressed.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2 Ballast water exchange

2.1 Application
The requirements given in this section apply to ships where ballast water exchange at sea is accepted.

2.2 Documentation requirements

2.2.1 The builder shall submit documentation as required by *Table 1*. The documentation will be reviewed by the Society as a part of the class contract.

*Table 1 Documentation requirements for BWM(E[m])*

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ballast system</td>
<td>S020 Pressure drop analysis</td>
<td>When ballast water exchange using flow-through method is applied, the back pressure in tank when overfilling with largest available pump.</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>Z230 – Ballast water management plan</td>
<td>For <strong>BWM(E[s])</strong>; documentation showing stability and strength compliance shall be included.</td>
<td>AP</td>
</tr>
</tbody>
</table>
2.2.2 For general requirements for documentation, including definition of the info codes, see DNVGL-CG-0550 Sec.6.

2.2.3 For a full definition of the documentation types, see DNVGL-CG-0550 Sec.5.

2.2.4 The vessel shall be provided with:
— a ballast water record book
— a copy of the approved ballast water management plan according to the G4 guideline of the convention.

2.3 General requirements

2.3.1 Strength

2.3.1.1 All strength requirements applicable to the ship shall be met during the ballast water management operation. Special consideration shall be given to the following parameters, as relevant depending on the method:
— hull girder strength (bending, shear and torsion)
— sloshing in tanks
— bottom slamming
— overpressure in tanks

2.3.2 Stability

2.3.2.1 All stability and trim requirements applicable to the ship shall be met during the ballast water management operation.

2.3.2.2 Free surfaces of ballast tanks that may become slack during the ballast water management operation process shall be accounted for.

Guidance note:
It is recommended to account for the maximum free surface effect of a tank even when the tank is nearly empty or nearly full.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3.3 Visibility, propeller immersion and forward draught

2.3.3.1 The visibility requirements as set forth by SOLAS Ch.V, Reg.22 shall be observed during the ballast water management operation. The same applies for propeller immersion and minimum draught.

Guidance note:
In case any of the above limits are exceeded, the guidelines included in IMO MSC/Circ. 1145 Precautionary advice to masters when undertaking ballast water exchange operations should be followed.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3.4 Performance

2.3.4.1 The relative positions of ballast water intake and discharge openings shall be such to preclude, as far as practicable, the possibility of contamination of replacement ballast water by water which is being pumped out.
2.3.4.2 Internal arrangements of ballast tanks as well as arrangements of ballast water piping inlet and outlet shall allow for required ballast water exchange and the clearing of sediments.

2.4 Requirements applicable to ships using flow-through method

2.4.1 Ballast water management plan

2.4.1.1 A table showing the volume of each tank, the available pumps and the estimated time for the flow-through of water, corresponding to a volume three times the tank volume, shall be included in the ballast water management plan. In cases the floating position changes due to using the flow-through method for partially filled tanks, the affected exchange steps shall be presented in the ballast water management plan as required by [2.6.1.1].

2.4.2 Piping and systems

2.4.2.1 The capability of the ballast water system to provide ballast water exchange by the flow-through method, without the risk of the tank being subject to a pressure greater than for what it has been designed, shall be demonstrated by water flow calculations, see Pt.4 Ch.6 Sec.4 [11.2.1].

2.4.2.2 The flow-through method, with water flowing over the deck, may not be permitted for ships with class notations referred to in Ch.6.

Guidance note:
The use of collecting pipes, internal overflow pipes or interconnecting pipe/trunk arrangements between tanks, may be used to avoid water flowing over the deck.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.5 Requirements applicable to ships using dilution method

2.5.1 Ballast water management plan

2.5.1.1 A table showing the volume of each tank, the available pumps and the estimated time for the exchanging of water corresponding to a volume, three times the tank volume, shall be included in the ballast water management plan.

2.5.2 Piping and systems

2.5.2.1 Level monitoring system shall be provided, where maintaining a constant level in a tank is essential to the safety of the ship during ballast water exchange.

2.6 Requirements applicable to ships using sequential method

2.6.1 Ballast water management plan

2.6.1.1 Detailed calculation, documenting compliance with stability requirements and strength limitations applicable to the ship, shall be presented for each step in the ballast exchange sequence. The following information at the start and end point of each step shall be included:

- ballast water volume for each tank
- involved pumps
- estimated time span
- strength values in relation to permissible values
- stability information under consideration of free surface effects during filling or discharging
— draught values at F.P., A.P. and heeling
— visibility and propeller immersion checks

For vessels equipped with an approved loading computer covering all relevant stability and longitudinal strength requirements, detailed calculations need not be presented provided that clear instructions regarding planning of the ballast exchange sequence by use of the loading computer are included.

2.6.1.2 For tankers and bulk carrier with class notation CSR, the requirements and restrictions set by the respective rules shall also be observed.

2.6.1.3 If the sequential method is applicable for at least one tank, exchange sequences based on at least one of the following loading conditions included in the stability booklet shall be included:
— standard ballast condition
— if applicable, the heavy ballast and the emergency ballast conditions
— a critical loading condition with cargo and ballast water onboard, for one of the stages (departure, mid voyage, arrival) where the least safety margin(s) to the valid stability and/or strength limits occur

Guidance note:
In case ballast water exchange is not possible to be performed on the critical loading condition within permissible strength and/or stability limits, such loading condition may be altered to a degree where compliance with the limits is possible. In such cases the altered departure and arrival conditions should be included in the ballast water management plan.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3 Ballast water treatment

3.1 General
The ballast water management system shall comply with the safety requirements in [3.3] and [3.4] and the performance standard as set forth by regulation D-2 of the convention and in [3.5].

3.2 Documentation requirements

3.2.1 Documentation shall be submitted as required by Table 2 and Table 3. Additional documentation may be required in special cases (e.g. as a result of the required Hazard analysis in chapter [3.4.2]).

Table 2 Documentation requirements related to functions for BWM(T)

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ballast system</td>
<td>S010 – Piping diagram (PD)</td>
<td>Connection to and details of the ballast water treatment system (including main components). Details of ballast water sampling points. A sample point installed before the BWM system may be relevant if a biological compliance test is required by flag.</td>
<td>AP</td>
</tr>
<tr>
<td>Object</td>
<td>Documentation type</td>
<td>Additional description</td>
<td>Info</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------</td>
<td>------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Z230 – Ballast water management plan</td>
<td>Details of components and operation of the BWM system. Description on transfer of control and external signals to be communicated between BWM system and alarm system and/or its remote control. Signals from external bypass valves to be detailed. It is recommended to include contingency measures as non-mandatory information in accordance with G4. The contingency measures should be relevant for the ship and in accordance with BWM.2/Circ.62.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>1080 – Data sheet with environmental specifications</td>
<td>If not type approved by the Society. An environmental test report is required.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>Z030 – Arrangement plan</td>
<td>Drawing indicating location of the ballast water treatment system. When separate treatment room is required, see [3.4.3], accesses, emergency escapes, gas detectors, ventilation and air locks shall be indicated.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>Z254 – Commissioning procedure</td>
<td>Procedure specific to the system installed onboard and in compliance with the G8 Guidelines.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>Z161 – Operation manual</td>
<td>Details of operation, maintenance, safety (hazard identification), environmental and human health impact and system design limitations in accordance with guideline G8 and approved by the administration.</td>
<td>FI</td>
<td></td>
</tr>
<tr>
<td>G010 – Hazard analysis</td>
<td>If not type approved by the Society and if the BWM system or the storage tanks for process chemicals could emit harmful gases e.g. hydrogen or ozone.</td>
<td>FI</td>
<td></td>
</tr>
<tr>
<td>I020 – Control system functional description</td>
<td>If not type approved by the Society, a description of safety system, independent of the BWM control system shall be submitted.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>I030 – System block diagram</td>
<td>If not type approved by the Society, a diagram of safety system, independent of the BWM control system shall be submitted.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>I150 – Circuit diagrams</td>
<td>If not type approved by the Society, a diagram of safety system, independent of the BWM control system shall be submitted.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>H050 – Structural drawing</td>
<td>Foundation of the BWM system.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>H050 - Structural drawing</td>
<td>Tanks containing potentially hazardous liquid chemicals.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>Z030 – Arrangement plan</td>
<td>Filling arrangements, maintenance access, air pipes, sounding, drip trays and drain systems from drip trays, ventilation, gas detection, pressure and temperature monitoring for tanks containing potentially hazardous liquid chemicals. Fire fighting measures if relevant.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>G080 - Hazardous area classification drawing</td>
<td>For BWTS components generating hazardous gases.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>Object</td>
<td>Documentation type</td>
<td>Additional description</td>
<td>Info</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Electrolysis unit</td>
<td>S010 – Piping diagram (PD)</td>
<td>Auxiliary systems, e.g. for ventilation of hydrogen with all detectors and sensors for hazardous gases generated by the process.</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>E170- Electrical schematic drawing</td>
<td>Emergency power supply to blowers for dilution of hazardous gas.</td>
<td>AP</td>
</tr>
<tr>
<td>Ozone system</td>
<td>Z050 Design philosophy</td>
<td>Details of the installation in accordance with alternative 1, 2 or 3 as described in Pt.4 Ch.6 Sec.7 [2.2].</td>
<td>AP</td>
</tr>
<tr>
<td>De-oxygenation system</td>
<td>S010 – Piping diagram (PD)</td>
<td>Auxiliary systems, e.g. for PV valves for ballast tank vent heads. Detectors for hazardous gases generated by the treatment process and/or oxygen detectors.</td>
<td>AP</td>
</tr>
<tr>
<td>Heat treatment</td>
<td>S010 – Piping diagram (PD)</td>
<td>Auxiliary systems, e.g. for heating arrangements.</td>
<td>AP</td>
</tr>
</tbody>
</table>

AP = For approval

Table 3 Certification requirements for BWM-T

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
</tr>
</thead>
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<tr>
<td>Ballast water treatment system</td>
<td>TA</td>
<td>Administration</td>
</tr>
<tr>
<td>Pressure equipment</td>
<td>PC</td>
<td>Society</td>
</tr>
</tbody>
</table>

3.2.2 For general requirements to documentation, including definition of the info codes, see DNVGL-CG-0550 Sec.6.

3.2.3 For a full definition of the documentation types, see DNVGL-CG-0550 Sec.5.

3.2.4 The vessel shall be provided with:
— a ballast water record book
— operation, maintenance and safety manual approved by the administration (reference in type approval certificate is sufficient)
— type approval certificate of the BWMS
— installation specifications (i.e. copy of approved drawings, P&ID)
— an approved installation commissioning procedure specific to the BWM system
— a copy of the approved ballast water management plan (developed according to the G4 guideline of the convention including details on the BWM system and operation of the BWM system)

3.3 Safety requirements for ballast water treatment systems

3.3.1 Piping

3.3.1.1 The BWM system shall be provided with by-pass or override arrangement to isolate it from any essential ship system to which it is connected.
Guidance note:
For connections to other essential systems, the by-pass or override arrangement should be possible from the station where the other essential system is operated. If not possible to by-pass or override remotely from the operation stations of the other essential system, at least an instruction plate, explaining how/where to override or by-pass the BWM system to make the essential system in operation, should be posted at each station and the operation station for the BWM system.

For passenger ships and special purpose ships (SPS) ships, override or bypass of the BWM system from bilge system should be possible from above freeboard deck.

For passenger ships and SPS ships (with more than 60 persons on board) any equipment essential for operation of electrically powered remote controlled bilge valves (or valves to make bilge system in operation) should be power supplied from an emergency source.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.3.1.2 Plastic pipes in the BWM system may be accepted if isolation valves are fitted at the connection between the BWMS and the main ballast pipe to prevent uncontrolled flooding of the spaces where the BWM system is located. The isolation valves including actuators, shall be steel material or equivalent and be remotely controlled from outside the space.

Plastic pipes shall have low surface flame spread characteristics (see Pt.4 Ch.6 Sec.2 [1.7.1]).

Guidance note:
The layers of safety are any actions that do corrective changes to the process.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.3.1.3 Two layers of safety are required for any part of the BWM system installation which can be isolated and cause internal pressure or temperature increase. At least one of the layers shall have shutdown initiated by a safety system independent of the BWM control system.

Guidance note:
The layers of safety are any actions that do corrective changes to the process.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.3.1.4 Where a vacuum may occur in the ballast line due to the height difference, suitable protection means shall be provided, e.g. P/V valves or breather valves, and their outlets shall lead to safe area on open deck.

3.3.2 Automation and electrical installations

3.3.2.1 For instrumentation and automation, including computer based control and monitoring, the requirements in this subsection are in additional to those given in Pt.4 Ch.9.

3.3.2.2 The electric and electronic components of the treatment system shall comply with the environmental tests required by the G8 guidelines and Pt.4 Ch.8 Sec.3.

Guidance note:
Electromagnetic compatibility (EMC) type tests may be omitted provided measures are taken to attenuate these effects on the distribution system, so the safe operation of the ship is assured, if necessary.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.3.2.3 The electrical installation of the BWM system shall comply with Pt.4 Ch.8.

3.3.2.4 Arrangements of electrical installations in hazardous areas shall comply with Pt.4 Ch.8 Sec.11, based on area classification. Any moving parts, which are fitted in hazardous areas, shall be arranged so as to avoid the formation of static electricity.

Guidance note:
In case of oil recovery operation (OILREC), equipment for ballast water treatment unit not certified according to Pt.4 Ch.8 Sec.11, but located in hazardous area, should be disconnected in accordance with Ch.5 Sec.11 [5.8.3], and the relevant procedure should be described in the ballast water management plan. This will restrict the ship to only operate in water under the jurisdiction of one party when in OILREC mode in order to be in compliance with the Convention.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
3.3.3 Location of ballast water management systems

3.3.3.1 A support structure for the foundation of the BWM system shall be provided, taking into consideration all operational conditions of the BWM system and Pt.3 Ch.11 Sec.2 [3.1.1].

3.3.3.2 Treatment systems intended to treat ballast water from ballast tanks adjacent to cargo tanks, containing liquid oil or chemicals with flash point of 60°C or below, shall be located within the cargo area. Exception is permitted in [3.3.3.3].

3.3.3.3 For ships with cargo tanks containing liquid oil or chemicals with flash point of 60°C or below, treatment systems may be placed in gas safe area (i.e. the engine room) if any piping for ballast water treatment from gas safe area to the cargo area are led above deck and led through non-return arrangements. Non-return arrangements shall follow IACS UR M74. Exception is permitted in [3.3.3.8].

Guidance note:
Chemicals injected into the ballast water during discharges also regarded as part of the treatment.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.3.3.4 Where the BWM system is installed in a separate compartment that is not defined as a hazardous area, the compartment shall be fitted with an independent mechanical ventilation system providing at least six (6) air changes per hour, or as specified by the BWM system manufacturer, whichever is higher.

3.3.3.5 Where the BWM system is installed in a compartment that is defined as a hazardous area, the compartment shall be fitted with an independent mechanical ventilation system providing at least twenty (20) air changes per hour, or as specified by the BWM system manufacturer, or as complying with relevant requirements in IEC 60092-502, IBC Code, IGC Code. whichever is most stringent.

Guidance note:
Detail ventilation requirements in hazardous area of various ship types are described in Pt.5 Ch.5 Sec.6, or Pt.5 Ch.6 Sec.10, or Pt.5 Ch.7.

For oil tankers (not chemical tankers), a ventilation capacity of eight (8) air changes per hour may be accepted if the compartment is not adjacent to cargo tanks or is located on open deck. The compartment should also be without cargo/gas leakage sources.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.3.3.6 For BWM system making use of active-substances, additional requirements and restriction regarding installation location apply (see [3.4.3]).

3.3.3.7 If the BWM system is using a chemical addressed as non-hazardous by the material safety and data sheet (MSDS) with regards to storage (e.g. cleaning solutions), this can be stored in the engine room, but [3.4.4.3] to [3.4.4.9] applies.

3.3.3.8 Pipe penetration for pipes with small diameter (e.g. used for BWM system monitoring/control) from hazardous area to safe area (e.g. E/R) may be accepted on case-by-case consideration. In this case, additional safety requirements according to UR M74 3.1.7 will apply.

3.4 Additional safety requirements for ballast water treatment systems making use of active substances

3.4.1 Application

3.4.1.1 The requirements in this subsection are applicable to treatment systems using or generating hazardous gases, solids and/or liquid chemicals.
Guidance note:
Hazardous chemicals are defined as any chemical representing flammable, explosive, toxic, corrosive and/or oxidizing hazard. This section is applicable to systems with hydrogen, chlorine gas, ozone, acids, chlorine dioxide or peroxide. For other chemicals, the international bulk chemical (IBC) code and material safety and data sheet (MSDS) can be used as a guidance to determine the level of hazard posed by a chemical.

3.4.2 Hazard analysis

3.4.2.1 A hazard analysis shall be a self-contained document addressing design and operational aspects of the BWM system and consider inter alia (see IMO MSC 83, INF2 and BWM.2/Circ.20 Guidance to ensure safe handling and storage of chemicals and preparations used to treat ballast water and the development of safety procedures for risks to the ship and crew resulting from the treatment process). The following shall be evaluated;
— BWM system installation location
— storage and handling of hazardous chemicals generated or used by the BWM system
— operation of the system (including alarms)
— fire hazards
— chemicals or preparations in treated ballast water
— ballast water tanks and its venting.

3.4.3 Location of ballast water management systems

3.4.3.1 If the BWM system or separate components used for storage, handling or generation of hazardous gases/liquids, can not meet the exemptions given in [3.4.3.2], the BWM system shall be located in a separate treatment room.

3.4.3.2 BWM systems or components that fulfil the following requirements, may be exempted from the requirements of [3.4.3.3] - [3.4.3.13]:
— The equipment or components are installed within other machinery spaces or the engine room.
— The piping follow requirements set in [3.4.5].
— Gas detection equipment is fitted in all locations where dangerous gas could be present due to a leakage. An audible and visual alarm shall be given at a manned location and shut down of the BWMS shall be initiated by a safety system, independent of the BWM control system.
— The manufacturer can demonstrate as in [3.4.2] that the amount of liquid chemicals or gases generated are far below the normally recognized thresholds for toxic, flammable, explosion or suffocating hazards.
— The system does not include any storage of hazardous chemicals.

3.4.3.3 The treatment room shall be a separate compartment surrounded by steel decks and bulkheads and have only access directly to open deck. If a secondary containment dimensioned to handle a full tank leak is arranged, the access may be through an air lock to other spaces below deck. The room shall be fitted with self-closing doors opening outwards and with a sill height of at least 300 mm. Decks and bulkheads shall be without openings and pipe and cable penetrations etc. shall be sufficiently tight to prevent leaking of gas or liquid entering other rooms and spaces. The compartment shall be positioned outside of any combustible, corrosive, toxic, or hazardous areas unless otherwise specifically approved.

3.4.3.4 If access through air lock is applicable, the requirements in Pt.5 Ch.6 Sec.3 [3.1.6] and Pt.5 Ch.6 Sec.10 [2] shall be met.

3.4.3.5 Fire integrity of the treatment room shall be equivalent to other machinery spaces.
3.4.3.6 The ventilation system for the treatment room shall be separated from other ventilation systems, shall be of the exhaust type and to give minimum six (6) air changes per hour or as specified by the BWM system manufacturer, whichever is higher. Additional requirements may apply for emergency ventilation (see [3.4.3.8]). If the gases stored, generated or evaporated from liquid state are heavier than air the ventilation exhaust shall be from the bottom of the treatment room.

3.4.3.7 The ventilation shall be arranged such that a single failure cannot cause a ventilation below the required capacity.

3.4.3.8 The treatment room shall be provided with gas detection. Gas detection alarms shall be given locally and at a manned location. A safety system, independent of the BWM control system, shall initiate the following actions upon gas detection:

— shut down of the BWM system
— start emergency ventilation system with ventilation capacity according to recognized standards, recommendations in material safety data sheet (MSDS) or manufacturers guideline.

Additional requirements for ozone systems are given in Pt.4 Ch.6 Sec.7 [2.4.9].

3.4.3.9 All ventilation outlets from the treatment room shall have visible signs informing that the ventilation outlet may contain hazardous gas. The outlets shall be at safe locations with regard to:

— the hazards of possibly leaked gases in the ventilation air
— intake of ventilation air into other ventilation systems on the ship
— recycling between the ventilation outlets and intakes for the treatment room

3.4.3.10 Thin-plate ventilation ducts for other spaces shall not be lead through the treatment room.

3.4.3.11 The compartment shall be arranged with a bilge system separated from the ship's main bilge system, and shall be operable from outside the compartment. The bilge system shall be compatible with the chemicals carried.

3.4.3.12 When containing gases or liquid chemicals used or generated during treatment having flash point of 60°C or below, or acids where the IBC code requires compliance with chapter [15.11.5]; the treatment compartment shall be considered as a hazardous area zone 1 as defined in IEC Standard 60092-502. The hazardous zone plan shall be created in accordance with requirements in Pt.5 Ch.6 Sec.12.

3.4.3.13 For spaces where acids are stored and no secondary containment is installed, the floor shall be lined with suitable material to a height corresponding to a full tank leak.

3.4.4 Handling and storage of gas and liquid chemicals

3.4.4.1 The requirements for handling of liquid chemicals given in the IBC code and gases given in the IGC code shall be used as guidelines.

3.4.4.2 Drain water from sample units or from cleaning liquid containing active substances should lead back to the ballast line or be neutralised before discharge. Alternative arrangements shall be approved on an case by case basis.

3.4.4.3 The chemical tanks shall be located in a well ventilated space.

3.4.4.4 Inspection and filling of the chemical tanks shall be easy and accessible.

3.4.4.5 Drip trays shall be arranged below the liquid chemical tanks, tank connections, flanges and pumps serving the tank. An efficient drain system from the drip tray shall be arranged.
3.4.4.6 The material of the chemical tank, secondary containments, drip trays and piping shall be suitable to
the chemicals intended to be used.

Guidance note:
See also IACS UI CC6.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.4.4.7 The operation manual for the BWM system shall include a description of filling procedures, alarms,
emergency procedures etc. including an MSDS sheet of the chemical stored. The manual shall include a
procedure for handling small and large leaks and it shall be available onboard.

3.4.4.8 Signs on the chemical tank stating the content of the tank and simple and essential safety measures
shall be available.

3.4.4.9 Handling and storage of chemicals and relevant personal protective equipment (PPE) shall be
according to IBC code or MSDS. At least two sets of PPE shall be available in a well marked locker, close to
the location or entrance of the chemical tank.

3.4.4.10 Chemical tanks containing hazardous gases/liquids shall be equipped with:
— Air pipes leading to safe area on open deck.
— Ventilation outlets shall not be located in places where pesonnel/passangers pass by or stay (i.e. close to
  filling station).
— Ventilation outlets shall be arranged to avoid water ingress.
— If the chemical is a liquid; a high level alarm in compliance with Pt.5 Ch.6 Sec.13 [2.2.2] is required.
— Monitoring measures to give alarm in case of any unfavourable chemical reactions that could emit
dangerous gases/liquids or lead to increased pressure. Monitoring measures shall have at least two means
of detection and give alarm. Safety measures shall be considered case by case, but the IBC code shall be
used as reference.
— In case any safety systems are dependent on power supply, the safety system shall be connected to UPS
  or emergency power (i.e closing of tank valves).
— Leak detection in the drip trays. When a leak is detected, an audible and visual alarm shall be given at a
  manned location and a shut down of the BWMS shall be initiated by a safety system, independent of the
  BWM control system.
— Any drainage of the drip trays shall be made of a material suitable for the chemical in the tank.

3.4.4.11 The construction of the chemical tank shall be approved by the Society in compliance with Pt.2 Ch.4
Sec.8. The independent tank shall be leak and structure tested according to Pt.2 Ch.4 Sec.8 Table 3

3.4.4.12 Storage spaces dedicated for single components generating small amounts of flammable liquid
chemicals or explosive gases shall be regarded as hazardous area zone 1 and shall be gas tight when
installed in a gas safe area.

3.4.4.13 Safety, spillage and fire fighting measures will be considered on a case by case basis, depending on
the products used.

3.4.5 Requirements to piping systems used for hazardous gas or liquid

3.4.5.1 All piping shall in general be in compliance with Pt.5 Ch.6 Sec.6 if not specifically mentioned
otherwise in these rules.

3.4.5.2 Any part of the BWM system installation which can be isolated and generate hazardous gases or
liquids shall have detection and shut down of the BWMS in accordance with [3.3.1.3].

3.4.5.3 Piping systems containing hazardous gas or liquid diluted to concentrations below flammable,
explosive, corrosive or significant toxic levels shall be according to the following requirements:
— Flange connections shall be minimized as far as possible.
— Gas pipes (i.e. ventilation pipes) shall always be ascending.
— To verify sufficient dilution, two independent means of detection shall be present (i.e. flow sensor and chemical gas/liquid detection sensor). Detection of insufficient dilution (i.e. gas concentration at 60% of LEL) shall initiate an audible and visual alarm at a manned location and a shut down of the BWMS shall be initiated by a safety system, independent of the BWM control system.
— Dilution fans (if relevant) shall be arranged with redundancy.
— One of the fans shall be connected to an alternative source of power (UPS or emergency power). A single failure shall not cause a complete dilution failure.
— Any electrical installations in contact with diluted flammable or explosive gas shall be certified safe for zone 1 in accordance with Pt.4 Ch.8 Sec.11.
— Outlets from pipes leading to open deck shall have visible signs informing that the ventilation outlet may contain hazardous gas.

Guidance note:
Pipes leading to open deck should be routed to 2 m above deck away from and at least 4.5 m horizontal distance from ventilation inlets, openings to accommodation and service spaces. Outlets shall not be located in places where personnel/passengers pass by or stay.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.4.5.4 Piping systems containing hazardous gas or liquid at concentrations that are flammable, explosive or significantly toxic (as identified in hazard analysis, see [3.4.2]) shall be according to the following requirements:
— Double walled pipes or equivalent (i.e. full penetrations butt welding).
— Flange connections may be accepted on case-by-case consideration. In this case, double wall pipe, spray shield, a sensor for gas detection or equivalent shall be located in the vicinity of any flange.
— The extent of piping system shall be minimized, preferably in the same compartment or room.
— Piping systems shall be routed to avoid damage from dropped objects, and shall avoid routing close to the ship side or bottom to reduce the likelihood of pipe rupture in case of collision or grounding.
— Piping system shall be away from heat sources.
— Material of the piping system shall be suitable for the media flowing in it.
— Piping system shall not be located within the crew accommodation spaces, the navigating bridge or such that all accesses to the main engine room will be blocked in case of pipe rupture.

3.4.5.5 Piping systems containing hazardous gas or liquid shall be marked according to ISO14726 or equivalent. Ozone piping shall be marked with a distinct colour, separating it from other piping.

3.5 Performance requirements

3.5.1 Sampling points

3.5.1.1 The ballast water system shall be provided with sampling facilities, arranged according to the provisions of the guidelines for ballast water sampling (G2 guidelines). Accordingly, the sampling point shall be arranged in the discharge pipe as close as possible to the shell.

Guidance note:
In accordance with the guideline for commissioning testing, BWM.2/Circ.70, a sample port installed before the BWM system may be relevant or a direct harbour sample may be used to characterize the ambient water.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
3.5.2 Treatment rated capacity

3.5.2.1 BWM systems shall be operated within approved flow range and within treatment rated capacity (TRC) specified in the flag administration type approval certificate.

In case the installed ballast water pump capacity is higher than the TRC of the BWM system, flow control measures shall be installed.

 Guidance note:

If the flow rate is higher than the TRC, a warning should be given. The warning should turn into an alarm and be logged in the system if the high flow rate above the TRC continues (beyond the time approved during type approval process).

Gravity flow through the treatment system is allowed, given that flow and pressure are within the specified range of the type approval certificate.

---end---of---guidance---note---

3.5.2.2 When treatment systems are duplicated to meet a specific ballast pumping capacity, flow distribution between different treatment units shall be done in such a way that the individual flow rate through each unit is within the range given in the type approval certificate.

 Guidance note:

One of the following measures can be accepted:

— flow control and flow measurement for each individual flow
— uniform flow proven by CFD modelling for the installed piping and BWM system
— flow measurements during commissioning.

---end---of---guidance---note---

3.5.3 Automation

3.5.3.1 In case of any failure compromising the proper operation of the treatment system, audible and visual alarm signals shall be given in all stations from which ballast water operations are controlled.

3.5.3.2 Any possible bypass of the treatment system shall activate an alarm by the BWM control equipment. The bypass event shall also be logged in the ballast water record book.

 Guidance note:

Use of ballast pumps not connected to the treatment system is considered a bypass of the BWM system. Gravity uptake or discharge may be considered as a bypass for BWM systems installed in the ballast line. Discharge of untreated water may be considered as a bypass for in-tank systems.

---end---of---guidance---note---

3.5.3.3 The BWM control equipment shall be able to log all general alarms, operational alarms, system design limitation parameters, any changes to system design limitation parameters and bypass alarms for 24 months in accordance with part 5 of the G8 guideline. If the BWM control equipment has been de-energized without the possibility to log any bypass alarms, the system shall log the time period for being out of operation when re-energized.

3.5.3.4 Logging of internal transfer of ballast water is not required, unless if internal transfer of ballast water within the ship, (e.g. anti-heeling operations) may affect compliance by the ship with the standard described in regulation D-2 (i.e. for circulation or in-tank treatment). In such cases the internal transfer shall be recorded in the BWM control system as transfer operations.

3.5.4 Special conditions

3.5.4.1 In cases where ballast water uptake and discharge is done at the same location during loading/unloading of the ship, there is no transport of species to be considered from one location to another. However, remaining untreated water and sediments in the ballast water tank may be a contamination source
in the next location. A description of the means to remove untreated water in the same location before voyage shall be included in the ballast water management plan.

**Guidance note:**
Port state control should be contacted for clarification of local regulations with regards to sediment management.

---end---of---guidance---note---

3.5.4.2 Systems with combined ballast and cargo piping and pumping shall have provisions to thoroughly clean and flush the common pipeline before ballasting or discharge of ballast water. This shall be described in the ballast water management plan.

**Guidance note:**
Pipelines may also include untreated water. To avoid contamination during discharge of treated water, remaining untreated water in pipelines should be discharged in the same location or treated before voyage. Means to discharge or treat remaining untreated ballast water in relevant pipelines should be provided in the ballast water management plan.

---end---of---guidance---note---

3.5.4.3 Alternative means of ballast water treatment where water is circulated in the ship and through a BWM system can be accepted on a case by case basis, but shall be within the boundaries of the type approval limitations (i.e. holding time). For in-tank treatment, discharging the water before completed treatment will be regarded as a bypass. Means to control what water is treated or not shall be recorded in the ballast water management plan. Detailed operational instructions including how to prevent discharge of untreated waters shall be included in the ballast water management plan.

**Guidance note:**
Operation according to type approval certificate, control and recording of status on valves, treatment sequence, stability and strength of the ship will be considered.

---end---of---guidance---note---
SECTION 2 ENVIRONMENTAL CLASS - CLEAN

1 General

1.1 Introduction

The additional class notations **Clean, Clean(Design), Clean(Tier III) and Clean(Design,Tier III)** set requirements for ship's design, operation and equipment reducing the environmental impact from emissions to air, discharges to sea, and deliveries to shore from vessels. The requirements for these additional class notations are in compliance with, or more extensive than those found in international standards currently in force.

1.2 Scope

The scope of the additional class notations **Clean, Clean(Design), Clean(Tier III) and Clean(Design,Tier III)** is to attain a vessel with controlled environmental standards of design and performance. Compliance with the rules shall be verified through inspection, measurements and sampling of defined environmental parameters in accordance with the requirements of the rules in this section and in compliance with identified standards and guidelines. Effects and parameters covered are described in [1.5] by reference to technical standards and installations, and their operation.

1.3 Application

The additional class notations **Clean and Clean(Design)** applies to vessels complying with the requirements specified in **Table 1**:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Class notation with qualifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessels shall be enrolled in the emergency response service (ERS)</td>
<td>Clean</td>
</tr>
<tr>
<td>(ERS) administered by the Society or similar service provided by</td>
<td>Yes</td>
</tr>
<tr>
<td>another recognized organization.</td>
<td>Clean(Design)</td>
</tr>
<tr>
<td>Vessels shall hold class notation, <strong>NAUT(AW)</strong> or <strong>NAUT(OC)</strong>,</td>
<td>Not required</td>
</tr>
<tr>
<td>see Ch.3 Sec.3 or <strong>NAUT(OSV)</strong>, see Ch.3 Sec.5</td>
<td>Yes</td>
</tr>
<tr>
<td>Vessels shall have BWMS according to the International</td>
<td>D-1 or D-2 Standard</td>
</tr>
<tr>
<td>Convention for the Control and Management of Ships’ Ballast</td>
<td>D-2 standard</td>
</tr>
<tr>
<td>Water and Sediment.</td>
<td></td>
</tr>
<tr>
<td>Vessels shall hold class notation <strong>VCS(2)</strong> (Ch.4 Sec.11).</td>
<td>Yes</td>
</tr>
<tr>
<td>(vapour emission from cargo tanks)</td>
<td>Clean(Design)</td>
</tr>
<tr>
<td>Vessels shall hold class notation <strong>ECA(S0x-A)</strong> (Sec.3).</td>
<td>Not required</td>
</tr>
<tr>
<td>(meeting requirements for emission control areas)</td>
<td>Yes</td>
</tr>
<tr>
<td>Statement of compliance with respect to MARPOL Annex V.</td>
<td></td>
</tr>
</tbody>
</table>

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Rules for classification: Ships — DNVGL-RU-SHIP Pt.6 Ch.7. Edition July 2019

Environmental protection and pollution control

DNV GL AS
### Environmental protection and pollution control

1. Vessels less than 5000 GT and vessels designed for offshore operations with class notation **SF** or better damage stability do not need to meet this requirement. Gas fuelled vessels do not need to meet this requirement if not intended for carrying cargo with large pollution potential.

2. **NAUT(OSV-A)** is applicable to offshore vessels, **NAUT(AW)** is applicable to passenger ships, tankers, bulk carriers, container ships, etc., **NAUT(OC)** is applicable for vessels largely operating on the high seas.

3. Statement of compliance for inventory of hazardous materials may be accepted as a replacement to class notation **Recyclable**.

4. Vessels shall have either class notations **BWM(E[m])** or **BWM(T)** or statement of compliance/certificate of compliance with standard D-1 or D-2 of the international ballast water management convention.

5. Vessels shall have either class notations **BWM(T)** or statement of compliance/certificate of compliance with standard D-2 of the international ballast water management convention shall.

6. Applies to **Tanker for Oil**, **Tanker for Oil Products** or **Tanker for Chemicals**.

7. Gas fuelled vessels, ships continuously operating with low sulphur fuels [below 0.1% sulphur mass content] and vessels equipped with type approved exhaust gas cleaning system for **SO**\textsubscript{x} are accepted as equivalent to the **ECA** notation.

### 1.4 Class notation and qualifiers

1.4.1 The class notation **Clean** identifies the basic requirements for controlling and limiting operational emissions and discharges. The requirements are specified in [2].

1.4.2 The class notation **Clean** with the qualifier **Design** identifies additional requirements for controlling and limiting operational emissions and discharges. In addition, this qualifier specifies design requirements for protection against accidents and for limiting their consequences. The requirements are specified in [3].

1.4.3 When vessels complying with requirements of either **Clean** or **Clean(Design)** class notations, the qualifier **Tier III** may be assigned for those vessels complying with the NO\textsubscript{x} emission requirements of Tier III according to MARPOL Annex VI, Regulation 13.

### 1.5 Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>anti-fouling systems</td>
<td>A coating, paint, surface treatment, surface, or device used to control or prevent attachment of un-wanted organisms.</td>
</tr>
<tr>
<td>ballast water</td>
<td>Water with its suspended matter taken onboard a vessel to control trim, list, draught, stability or stresses of the vessel.</td>
</tr>
<tr>
<td>ballast water treatment system</td>
<td>Any system which processes ballast water such that it meets or exceeds the Ballast Water Performance Standard in Regulation D-2 in the Ballast Water Management Convention. The BWTS includes ballast water treatment equipment, all associated control equipment, monitoring equipment and sampling facilities.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>bilge water tank</td>
<td>Bilge water tank(s) in accordance with requirement at [3.3.6.6] includes: 1) bilge holding tank(s) 2) bilge settling tank(s) 3) clean drain tanks (if fitted according to IBTS).</td>
</tr>
<tr>
<td>biofouling</td>
<td>The accumulation of aquatic organisms such as micro organisms, plants, and animals on surfaces and structures immersed in or exposed to the aquatic environment. Biofouling can include microfouling and macrofouling.</td>
</tr>
<tr>
<td>cargo handling systems</td>
<td>Cargo handling systems comprise:  — cargo tank vents for tankers with cargoes where evaporation may occur during loading, transport and discharge. (e.g.: tanker for oil, tanker for chemicals, tanker for liquefied gas, tanker for oil products, offshore service vessels and well stimulation vessels)  — pumping and piping systems for tankers carrying cargoes that may cause global or local pollution.</td>
</tr>
<tr>
<td>clean drain tank</td>
<td>A tank which holds internal drains such as those resulting from the leakage of and condensate from equipment used for seawater, freshwater, steam, air conditioning etc. which are not normally contaminated by oil.</td>
</tr>
<tr>
<td>deliveries to shore</td>
<td>Delivery of potential pollutants to shore facilities, for controlling, disposal, recycling, etc.</td>
</tr>
<tr>
<td>discharges to sea</td>
<td>All discharges to sea which are caused by or needed for operation of the vessel, energy consumers, cargo, passengers, and crew onboard a vessel, and any toxic discharges caused by protection and conservation of vessel or cargo.</td>
</tr>
<tr>
<td>emissions to air</td>
<td>All emissions to air which are caused by or needed for the operation of the vessel, energy consumers, cargo, passengers, and crew onboard a vessel, and any toxic emissions caused by operation, protection and conservation of vessel or cargo.</td>
</tr>
<tr>
<td>food waste</td>
<td>Any spoiled or unspoiled victual substances, such as fruits, vegetables, dairy products, poultry, meat products, food scraps, food particles and all other materials contaminated by such wastes, generated onboard ship, principally in the galley and dining areas.</td>
</tr>
<tr>
<td>garbage</td>
<td>Garbage includes all kinds of provisions, domestic and operational waste excluding fresh fish and parts thereof, generated during normal operation of the vessel and liable to be disposed of continuously or periodically except those substances excluded specifically. Cargo residues from dry cargo vessels are considered as garbage. Sewage and waste oils are defined separately and not as garbage.</td>
</tr>
<tr>
<td>global warming potential, GWP</td>
<td>The GWP values are based on CO₂ as a reference substance over a time horizon of 100 years. The GWP values from the IPCC Fourth Assessment Report or latest IPCC publication shall be used.</td>
</tr>
<tr>
<td>greywater</td>
<td>Drainage from dishwasher, galley, shower, laundry, bath, washbasin drains and WC scuppers.</td>
</tr>
<tr>
<td>macrofouling</td>
<td>Large, distinct multicellular organisms visible to the human eye such as barnacles, tubeworms, or fronds of algae.</td>
</tr>
<tr>
<td>microfouling</td>
<td>Microscopic organisms including bacteria and diatoms and the slimy substances that they produce. Biofouling comprised of only microfouling is commonly referred to as a slime layer.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>oil residue (sludge)</td>
<td>The residual waste oil products generated during the normal operation of a vessel such as those resulting from the purification of fuel or lubricating oil for main or auxiliary machinery, separated waste from oil filtering equipment, waste oil collected in drip trays, and waste hydraulic and lubricating oils. Waste oils may be dealt with onboard, or pumped ashore. Cargo oil residues in slop tanks (see Residues of cargo oil and chemicals) are considered separate from operational waste oils.</td>
</tr>
<tr>
<td>oil residue (sludge) tank</td>
<td>A tank which holds oil residues (sludge) from which sludge may be disposed directly through the standard discharge connection or any other approved means of disposal.</td>
</tr>
<tr>
<td>oily bilge water</td>
<td>Water which may be contaminated by oil resulting from things such as leakage or maintenance work in machinery spaces. Any liquid entering the bilge system, bilge piping, tank top or bilge holding tanks is considered oily bilge water.</td>
</tr>
<tr>
<td>oily bilge water holding tank</td>
<td>Means a tank collecting oily bilge water prior to its discharge, transfer or disposal.</td>
</tr>
<tr>
<td>parts per million (PPM)</td>
<td>PPM means parts of oil per million parts of water by volume.</td>
</tr>
<tr>
<td>port</td>
<td>The vessel is considered in port from ordering stand by prior to entering port to ordering full ahead when leaving the port. The time will be confirmed by entries in the vessel's logbook.</td>
</tr>
<tr>
<td>processed clean bilge water tank</td>
<td>A tank which holds processed water from the oil filtering equipment.</td>
</tr>
<tr>
<td>refrigerants</td>
<td>Refrigerant media used in cargo refrigeration plants, provision plants, air conditioning and refrigeration systems onboard all vessels.</td>
</tr>
<tr>
<td>residues of cargo oil and chemicals</td>
<td>Remains of cargo (oil or chemical contaminated water from cargo tank area, slop tanks and cargo pump room).</td>
</tr>
<tr>
<td>sewage (black water)</td>
<td>— drainage and other wastes from all toilets and urinals — drainage from medical premises (dispensary, sick bay) via wash basins, wash tubs and scuppers located in such rooms — drainage from spaces containing living animals, or — other waste waters when mixed with any of the drainage systems defined above.</td>
</tr>
<tr>
<td>SOx emission control area (ECA emission control area)</td>
<td>SOx emission control areas are defined in the revised MARPOL Annex VI and in the EU Sulphur Directive. 99/32/EC as amended (2005/33/EC) with proposed amendments.</td>
</tr>
</tbody>
</table>

1.5.1 Abbreviations

Table 3 Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFC</td>
<td>chlorofluorocarbons</td>
</tr>
<tr>
<td>ECA</td>
<td>emission control areas</td>
</tr>
<tr>
<td>HCFC</td>
<td>hydrochlorofluorocarbons</td>
</tr>
<tr>
<td>HFC</td>
<td>hydrofluorocarbons</td>
</tr>
<tr>
<td>HFO</td>
<td>heavy fuel oil</td>
</tr>
<tr>
<td>IBTS</td>
<td>integrated bilge water treatment system</td>
</tr>
<tr>
<td>IHM</td>
<td>inventory of hazardous materials</td>
</tr>
</tbody>
</table>
1.5.2 International recommendations, standards and references

1.5.2.1 International recommendations, standards and references have been used as foundation for the rules, although the rule requirements may be more stringent. When setting the emission and discharge limits, and determining the measuring procedure, due consideration has been given to technical and practical limitations inherent in the design and construction of different types of vessels.

1.5.2.2 International recommendations, standards and references with provisions used by the Society when developing the rules are reflected in the references specified in [1.5.2.3] to [1.5.2.12]. Unless a particular edition is explicitly referred to, the latest edition of each standard applies.

1.5.2.3 General references
Generally the rules refer to applicable parts of Annexes I, II, IV, V and VI of MARPOL 73/78. Other references for specific areas are given in [1.5.2.4] to [1.5.2.12].

1.5.2.4 Antifouling paint
Requirements for restrictions to use of tributyltin (TBT) in antifouling paint refer to *International Convention on the Control of Harmful Anti Fouling Systems*, adopted by IMO in October 2001 (AFS/CONF/26).

1.5.2.5 Ballast water
Requirements for restrictions to transfer of harmful organisms in ballast water refer to the Convention.

1.5.2.6 Cargo handling vapour emission control systems
Following references are used:
— IMO *Standards for Vapour Emission Control Systems*, MSC/Circ.585 and revised MARPOL Annex VI, Regulation 15
— USCG Title 46, CFR Part 39.

1.5.2.7 Marine diesel engines
IMO’s *NOx Technical Code* (IMO MP Conf. 3/35 Res. 2).
1.5.2.8 Sulphur abatement technologies
If applicable, sulphur abatement technologies should be verified according to Resolution MEPC.184(59) adopted on 17th July 2009 Guidelines for on board exhaust gas-SOx cleaning system, taking into account local legislation (e.g. EU requirements) and amendments if any.
The sulphur abatement technology shall document thoroughly that any waste stream discharged into enclosed ports, harbours and estuaries have no impact on ecosystems, based on criteria communicated by authorities of port states to the IMO.

1.5.2.9 Refrigerants and fire fighting media
Refers to Montreal Protocol on Substances that Deplete the Ozone Layer.

1.5.2.10 Shipboard incinerators
Refers to IMO Resolution MEPC.76(40) on Standard specification for shipboard incinerators.

1.5.2.11 Bilge water separators
Refers to IMO Resolution MEPC.107(49) Revised guidelines and specifications for pollution prevention equipment for machinery space bilges of ships.

1.5.2.12 Sewage treatment plant
Refers to IMO Resolution MEPC.159(55) Recommendation on standards for the rate of discharge of untreated sewage from ships.

1.6 Procedural requirements

1.6.1 Documentation and certification requirements

1.6.1.1 Documentation shall be submitted as required by Table 4.

1.6.1.2 For general requirements to documentation, see DNVGL-CG-0550 Sec.6.

1.6.1.3 For a full definition of the documentation types, see DNVGL-CG-0550 Sec.5.

1.6.1.4 Documentation required with respect to class notation BWM(E[m]) and BWM(T) is given in Sec.1. Required documentation is the same for corresponding statement of compliance/certificate of compliance.

Documentation required with respect to class notation Recyclable is given in Sec.4. Required documentation is the same for corresponding statement of compliance. Documentation required with respect to class notations NAUT(OC), NAUT(AW) and NAUT(OSV) is given in Ch.3 Sec.3 and Ch.3 Sec.5 respectively. Documentation required with respect to class notation VCS(2) is given in Ch.4 Sec.11.

1.6.1.5 In addition to marine equipment required to be certified according to statutory requirements in MARPOL, the following certificates given in Table 4 are required for Clean(Design) class notation.

Table 4 Certificates required

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Certification standard</th>
<th>Additional description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilge water separator</td>
<td>Type approval certificate (TA)</td>
<td>Society</td>
<td>DNVGL-CP-0208</td>
<td>5 ppm separator</td>
</tr>
<tr>
<td>Bilge alarm (oil-content meter)</td>
<td>Type approval certificate (TA)</td>
<td>Society</td>
<td>DNVGL-CP-0485</td>
<td>5 ppm alarm</td>
</tr>
<tr>
<td>Ballast water treatment system</td>
<td>Type approval certificate (TA)</td>
<td>Society</td>
<td>DNVGL-CP-0209</td>
<td></td>
</tr>
</tbody>
</table>
1.6.2 In-service requirements

1.6.2.1 If approved arrangements, equipment or procedures are altered or modified, documentation shall be either resubmitted for approval or accepted by the attending surveyor at annual surveys.

1.6.2.2 The environmental performance of systems covered by the rules in this section shall be verified by inspection, measurements, and sampling, or by other equivalent means in accordance with the requirements of the rules in this section and in compliance with identified standards and guidelines. Data shall be gathered and kept onboard in appropriate logbooks for review during periodical surveys as defined in Pt.7 Ch.1 Sec.6 [16].

### Table 5 Documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
<th>Clean qualifiers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel and lubrication oil systems</td>
<td>H210 – Protected tank location drawing</td>
<td>Applicable for all tanks containing oil or oil based liquids.</td>
<td>AP</td>
<td>Design</td>
</tr>
<tr>
<td>Fuel oil system</td>
<td>Z160 – Operation manual</td>
<td>Including bunkering procedures and management plan for control of SOx emissions.</td>
<td>AP</td>
<td>All</td>
</tr>
<tr>
<td>Biofouling</td>
<td>Z160 – Operation manual</td>
<td>Biofouling management plan.</td>
<td>AP</td>
<td>Design</td>
</tr>
<tr>
<td>Sewage system</td>
<td>S010 – Piping diagram</td>
<td>Sewage management plan including sewage discharge log.</td>
<td>AP</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>Z160 – Operation manual</td>
<td>Capacity calculation of holding tanks for sewage and greywater.</td>
<td>FI</td>
<td>Design</td>
</tr>
<tr>
<td>Garbage disposal system</td>
<td>Z160 – Operation manual</td>
<td>Garbage management plan with garbage record book.</td>
<td>AP</td>
<td>All</td>
</tr>
<tr>
<td>Greenhouse gas handling</td>
<td>S010 – Piping diagram</td>
<td>Refrigeration and air conditioning systems.</td>
<td>AP</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>Z100 – Specification</td>
<td>Fire fighting systems, including data sheet for extinguishing media.</td>
<td>FI</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>Z110 – Data sheet</td>
<td>Refrigerants.</td>
<td>FI</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>Z160 – Operation manual</td>
<td>Refrigerant management procedures.</td>
<td>AP</td>
<td>All</td>
</tr>
</tbody>
</table>
### 2 Class notation Clean

#### 2.1 Introduction

**2.1.1 General**

2.1.1.1 The rules in this section give requirements for reducing emissions to air from energy producers, cargo-handling systems and service systems onboard the vessel. References are made to national and international recommendations, standards and guidelines on emission criteria in relation to the protection of the environment.

2.1.1.2 The rules in this section give requirements for limiting discharges to sea from energy producers, lubrication and hydraulic systems, cargo/passenger handling systems, waste/sewage systems, underwater antifouling systems and ballast water systems onboard vessels. References are made to national and international recommendations, standards and guidelines in relation to the protection of the environment.

---

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
<th>Clean qualifiers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil pollution prevention</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z180 – Maintenance manual</td>
<td>Template of the oil consumption log for oil/water interfaces and monitoring procedures.</td>
<td>FI</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>Z030 – Arrangement plan</td>
<td>Cargo and non-cargo manifold areas, including drip trays and oil spill prevention arrangements.</td>
<td>AP</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>Z231 – Bilge water and sludge management plan</td>
<td></td>
<td>AP</td>
<td>Design</td>
</tr>
<tr>
<td><strong>Sludge tanks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>H050 - Structural drawing</td>
<td></td>
<td>AP</td>
<td>Design</td>
</tr>
<tr>
<td><strong>Stern tube</strong></td>
<td>Z100 - Specification</td>
<td>Double barrier seal.</td>
<td>AP</td>
<td>Design</td>
</tr>
<tr>
<td><strong>Cargo piping system</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z030 – Arrangement plan</td>
<td>Side view of manifold arrangement. Including relevant data requested by OCIMF Standard Sec.1 and 2. Applicable for tankers for oil or chemicals.</td>
<td>AP</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>Z030 – Arrangement plan</td>
<td>Means to support hoses in way of ship’s side abreast of manifolds. Applicable for tankers for oil or chemicals.</td>
<td>AP</td>
<td>All</td>
</tr>
<tr>
<td><strong>Cargo storing arrangements</strong></td>
<td>H210 – Protected tank location drawing</td>
<td>Applicable for all tanks containing oil or oil based liquids, Applicable for tankers for oil or chemicals.</td>
<td>AP</td>
<td>Design</td>
</tr>
<tr>
<td><strong>Cargo compartments cleaning system</strong></td>
<td>S110 – Shadow diagram</td>
<td>Applicable for tankers for oil or chemicals.</td>
<td>AP</td>
<td>Design</td>
</tr>
</tbody>
</table>
2.1.3 All ships shall comply with applicable MARPOL convention requirements and International Convention on the Control of Harmful Anti Fouling Systems (AFS/CONF/26) regardless of any exemption(s) granted by flag state or other authorities.

2.2 Emissions to air

2.2.1 General

2.2.1.1 Fuel oil management and control shall be carried out in accordance with a fuel oil management plan and fuel oil log.

2.2.1.2 The fuel oil management plan shall include description of the fuel oil quality, sulphur content in the fuel used onboard and shall document the qualities of the fuel ordered and the qualities of the received fuel as described by the bunker delivery note, see MARPOL, Annex VI, Regulation 18.5 and 18.6, and 99/32/EU with amendments.

2.2.1.3 The fuel oil management plan shall incorporate adequate fuel change over procedure to ensure that the fuel utilised at the time when entering a SOx restriction area is of the required quality. Relevant log books shall provide proof that the fuel of the required quality has been utilized in the relevant areas.

2.2.2 Cargo evaporation

2.2.2.1 Tanker for oil or oil products and tanker for chemicals shall hold a valid class notation VCS(2), see Ch.4 Sec.11.

2.2.3 Refrigerants

2.2.3.1 The requirements in this section shall apply to all refrigeration systems having more than 10kg initial charge of a refrigerant including but not limited to cargo refrigeration plants, centralised air conditioning systems, provision plants, MGO chiller units. Domestic type stand-alone air conditioning units and refrigerators do not fall into requirements of this section.

Guidance note:
Domestic type stand-alone units are typically cabin refrigerators, water coolers, ice machines, small air-conditioning units, vending machines, etc.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.2.3.2 The use of ozone depleting substances is not permitted, ODP=0. The refrigerant may be any of the following:
— HFC
— natural refrigerants such as NH₃ or CO₂.

2.2.3.3 A list of all refrigerant systems onboard defined in [2.2.3.1] shall be included in the refrigerant management plan.

2.2.3.4 Refrigerant systems shall have suitable means of isolation to allow maintenance without releasing any bulk quantity of the refrigerant to the atmosphere. Isolating valves shall be provided to permit compressor removal and replacement without losing the refrigerant charge. A suitable permanent valve for a recovery connection should be provided on all appliances. Unavoidable minimum releases associated with recapture or recycling are acceptable provided recovery units are installed for the evacuation of the system.
2.2.3.5 For refrigerant recovery, compressors shall be capable of evacuating a system charge into a liquid receiver.

When the condenser itself shall be repaired the refrigerant shall be transferred to:
— other condenser(s) inside the system: if the system has two or more condensers, when one of them shall be repaired, the others shall have enough capacity to hold the entire charge of the refrigerant system
— outside of the refrigerant system: a dedicated container of sufficient volume is used to house the largest refrigerant circuit of the unit. This container shall be available and permanently located close to the unit.

The procedure for how to use the recovery unit shall also be provided onboard.

Additionally, recovery units and associated equipment shall be provided to facilitate evacuation of the system either into existing liquid receivers or into suitable reservoirs.

These requirements do not apply to systems using R717 (ammonia) as refrigerant due to safety reasons.

2.2.3.6 Annual refrigerant leakage shall be as small as possible but not more than 10% of the total refrigerant charge for each system. The leakage shall be documented through recorded consumption figures. The figures shall include topping up due to leakage, as well as renewal of refrigerant during repairs or overhauls. The refrigerant log shall at least include: date, system type, refrigerant type, type of failure, initial system charge, refrigerant added, refrigerant recovered, signature type of inspection performed and corrective actions.

If leakage is observed, corrective measures as detailed in the refrigerant management procedure shall be implemented.

2.2.3.7 Where different types of refrigerants are used, measures shall be taken in order to avoid mixing of these substances.

2.2.3.8 Refrigerants in refrigeration systems shall be controlled in a manner suitable for detection of all types of leakage.

One or more than one of the following methods for leak detection shall be used:
— an automatic detection system with sufficient sensitivity for refrigerants
— logging refrigerant volumes at regular intervals. As a minimum once per week or
— weekly control of leakages by portable refrigerant detector.

Guidance note:
The chosen solution may be in addition to, or in combination with, safety requirements specified in Pt.4 Ch.1. The requirements in this section do not replace requirements in Pt.4 Ch.1.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.2.3.9 The chosen method for detecting leakage shall be described in refrigerant management plan and justified to be suitable for the refrigeration system which is applied. Refrigerant management plan shall include the following procedures:
— how to monitor the refrigerant system with respect to possible leaks
— how often any such monitoring shall take place
— limits for when corrective actions shall be initiated
— procedures detailing the means to control leakage, venting and disposal of refrigerants
— log sheet for logging refrigerant volumes.

2.2.3.10 The log sheet shall include the following:
1) In case regular monitoring of the refrigerant’s volumes are used: type of system, date, time, volume, temperature and pressure of the refrigerant, % of leakage, corrective actions taken and signature of the responsible person.
2) In case portable refrigerant detectors are used: type of system, date, time, whether leakage is detected or not, location of leakage, corrective action taken and signature of the responsible person.
2.2.4 Fire fighting substances

2.2.4.1 Natural substances used in fixed fire fighting systems and extinguishers, are not considered damaging to the atmosphere. If other substances are used in fixed fire fighting systems that may have a global warming potential, the used substance shall comply with:

- GWP < 4000
- ODP = 0.

**Guidance note:**
The GWP values from the IPCC Fourth Assessment Report or latest IPCC publication should be used. Natural substances: Natural substances: e.g. argon, nitrogen, water spray, high expansion foam, CO₂. Note that CO₂ in this context is considered a natural substance without ODP or GWP since it will utilise CO₂ already present in the atmosphere.
Other substances: E.g. industrial substances including Hydrofluorocarbons (HFC) and sulphur fluorides.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3 Discharges to sea

2.3.1 General

2.3.1.1 Compliance with the rules in [2.3] shall be verified by means and measures as identified in [1.6]. Actual discharges shall be recorded as specified in [2.3.2] to [2.3.8].

2.3.2 Cargo handling

2.3.2.1 On tankers for oil or tankers for chemicals, all cargo manifolds shall be fitted with drip/spill trays with adequate means for closed drainage to a deck collecting tank or slop tank. The drip/spill trays shall have the following minimum dimensions:

- length: beyond forward and aft ends of the manifold
- width: at least 1.8 m, though such that the spill tray extends at least 1.2 m outboard of the end of the manifold flange
- depth: minimum depth 0.3 m.

2.3.2.2 For the collection of possible oil spills during cargo operations on tankers for oil the tank deck area shall be fitted with a closed drainage system with discharge to a deck collecting tank or a slop tank. The drainage system may be arranged either with a manually operated valve, or with an automatic deck scupper drainage system. The drainage shall be used during cargo operations where spillage may occur, and shall not affect normal deck drainage when at sea. When at sea, drainage from the deck area shall be ensured to avoid free surface effects with negative impact on the vessel’s stability.

2.3.2.3 Tankers for oil or tankers for chemicals shall have fitted means to adequately support hoses in way of vessel’s side abreast of manifolds. The support shall preferably be arranged as a horizontal curved plate or pipe section.

2.3.2.4 Tankers for oil or tankers for chemicals shall have fitted a closed sounding system and an overflow alarm which is independent of the closed sounding systems.

2.3.2.5 Other vessels carrying oil-containing liquids in bulk shall be equipped with arrangements as specified under Oil bunkering arrangements in [2.3.3]. This requirement does not apply to tanks carrying oily liquids during emergency operations only, e.g. tanks for oil recovered from oil spills at sea.
Guidance note:
This applies to e.g. supply vessels and other vessels carrying fuel oils and oil-based mud.

---end of guidance note---

2.3.3 Arrangements for fuel oil bunkering and other oil filling stations

2.3.3.1 All fuel oil bunker tanks shall be equipped with high level alarm to prevent overfilling. High level alarms need not be fitted to fuel oil bunker tanks that are provided with an overflow line to another fuel oil storage/service tank, which is fitted with a high level alarm. If vessel is fitted with a fuel oil overflow tank, there shall be a level alarm installed at low level of the fuel oil overflow tank as well.

Guidance note:
Alarm boxes located in the overflow line between fuel oil tanks and fuel oil overflow tanks may be accepted as equivalence to the level alarm required inside fuel oil overflow tanks.

---end of guidance note---

Guidance note:
High level alarms required in [2.3.3.1] may be triggered from the remote sounding system.

---end of guidance note---

2.3.3.2 The alarm signal shall be given where the person in charge of the bunkering or transfer operation will normally be located. The time between the high level alarm and the overfill level of the tank shall be at least 2 minutes.

2.3.3.3 Fuel oil, lubricating oil and other oil bunkering stations and other areas where spillage may occur shall be fitted with spill/drip trays to prevent oil escaping to sea. Minimum capacity: 80 litres for vessels less than 1600 GT, 160 litres for vessels equal to or larger than 1600 GT. Any spills at the bunker station shall have a reasonable chance of being trapped by the spill/drip tray.

2.3.3.4 Vent and overflow pipes for fuel oil tanks, lubricating oil tanks, hydraulic oil tanks and overflow tanks shall be fitted with spill/trays with the following minimum capacity: 40 litres for vessels less than 1600 GT, 100 litres for vessels equal to or larger than 1600 GT. Volume for the pipes shall be deducted from the tray capacity in the volume calculations. One spill/drip tray can be used for several vent and overflow pipes and the capacity shall minimum be as required for one pipe. Coaming height shall be minimum 15% of the largest horizontal dimension. Drawings showing spill/drip trays dimensions and volume calculations shall be submitted for approval.

2.3.3.5 Tanks with no risk of causing environmental contamination due to overfilling need not comply with [2.3.3]. Typically this applies to those small internal tanks which will be filled up locally from oil drums or their overflow vent pipes end up in engine room area.

2.3.4 Ballast water

2.3.4.1 Ballast water discharges from vessels shall comply with the D-1 (exchange method) or D-2 (treatment method) standard of the Convention with amendments and guidelines.

2.3.5 Bilge water

2.3.5.1 The vessel shall be arranged with a bilge holding tank with facilities for delivery ashore.

2.3.5.2 Fail-safe arrangements to avoid any discharge in case of bilge water separator malfunction shall be provided. The following requirements shall be fulfilled:
— The alarm is always activated whenever clean water is used for cleaning or zeroing purposes.
— The alarm is always activated whenever no flow of sample through the oil-content meter is detected by the flow sensor.
— Any alarm will activate the automatic stopping device and lead to re-circulation.
— The overall response time (including the response time of the bilge alarm) between an effluent discharge exceeding 15 ppm oil and to the automatic stopping device preventing the overboard discharge is less than 20 s.
— By-passing the bilge alarm during normal operation shall by no means be possible.
— Every access of the alarm (beyond check on instrument drift, repeatability of the instrument reading, and the ability to re-zero the instrument) requires the breaking of a seal.

2.3.6 Garbage

2.3.6.1 The vessel shall be provided with a garbage management plan. It shall be approved in accordance with Res. MEPC.220(63) 2012 Guidelines for the development of Garbage Management Plans.

Guidance note:
Statement of compliance with respect to MARPOL Annex V does not require garbage management plan to be approved, but class notation Clean requires both approval of garbage management plan and issuance of statement of compliance for MARPOL Annex V after successful survey onboard.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3.7 Sewage

2.3.7.1 The vessel shall be equipped with a type approved sewage treatment system in accordance with MEPC.159(55).

Guidance note:
Passenger ships operating within a special area should have a type approved sewage treatment system in accordance with MEPC.227(64) from 2016 (new passenger ships) or 2018 (existing passenger ships).

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3.7.2 All sewage shall be treated by the type approved sewage treatment system prior to discharge.

2.3.7.3 Bio waste (sewage sludge) which is produced during the sewage treatment operation can be discharged overboard according to MARPOL criteria, i.e. at a distance more than 12 nautical miles and at moderate rate when the ship is en route and proceeding at not less than 4 knots. The rate of discharge shall be according to recommendation on standards for the rate of discharge on untreated sewage given in MEPC.157(55).

2.3.7.4 Overboard discharge pipes for excess bio waste (sewage sludge) should be separated from overboard discharge pipes of treated sewage or an appropriate cleaning of the discharge pipe shall take place after each use of the sludge pump, e.g. flushing. The procedures shall be written in sewage management plan.

2.3.8 Oil/water interfaces

2.3.8.1 Anywhere lubricating oil or grease can leak to the sea shall be considered as oil/water interfaces. For example at:
— stern tube bearing
— rudder bearings (grease or oil)
— bow thrusters and azimuth thrusters
— fin stabilisers
— sea water cooled engines
— deck machinery
— hydraulically operated equipment.
2.3.8.2 Oil/water interfaces oil consumption shall be monitored. If evidence of leakage is found, corrective action shall be initiated and recorded in the oil/water interface log.

Guidance note:
The method for monitoring oil/water interface oil consumption may be automatic, or manual (at least once per week). Follow up should be such that smaller leaks are discovered to enable implementation of corrective action in case such leak is discovered. This requirement is in addition to the low level alarm for the stern tube lube. oil header tank, see Pt.4 Ch.4 Sec.1 Table 10.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3.8.3 Where non-fossil-base-oil lubricated type bearings are used, no monitoring is required.

2.4 Other aspects

2.4.1 Environmental responsibilities

2.4.1.1 All vessels shall have a responsible environmental officer onboard. Name/position of the officer in charge and relevant duties shall be listed in the required manuals. This person shall be responsible for the following:
— compliance with current environmental regulations
— management and control of the procedures and activities relevant to the requirements of this section
— implementation and use of relevant procedures
— upkeep of relevant logs
— training of personnel in relevant environmental practices.

The environmental officer may delegate tasks to other personnel but will remain responsible for the environmental conduct of the vessel.

2.4.2 Operation manuals

2.4.2.1 The requirements in this section are mainly technical but also supported by operation manuals on how to achieve the environmental benefits from the technical arrangements.

2.4.2.2 The operational manuals shall be readily available onboard and can be either a stand alone document, or be parts of the vessel’s SMS (safety management system) documentation, or be compiled in a clean class manual (or any combinations thereof).

2.4.2.3 The Clean class manual shall at least contain the following as independent chapters (any chapter may be exchanged to a reference on where to find elsewhere):
1) Fuel oil management plan (including bunkering procedures, sampling procedures, change-over procedures and safety aspects related to switch from heavy fuel oil (HFO) to marine gas oil (MGO)).
2) Ballast water management plan.
3) Biofouling management plan (for Clean(Design) only).
4) Sewage management plan (including piping diagram of the sewage system, sewage discharge log and capacity calculation of holding tank(s) for sewage and grey water).
5) Refrigerant management plan (including piping diagram of the refrigeration and air conditioning systems, data sheets of the refrigerants used and data sheets for extinguishing media in the fire fighting systems).
6) Bilge water and sludge management plan (including maintenance manual) (for Clean(Design) only).
7) Garbage management plan.
8) Template of the oil consumption log for oil/water interfaces.
3 Additional requirements for the qualifier Design

3.1 Introduction

3.1.1 General

3.1.1.1 The rules in this section give requirements for reducing emissions to air and limiting discharges to sea similar to or more stringent than those described in [2.1.1]. In addition certain aspects of the design of the vessel are prescribed. All vessels shall comply with the requirements in [2], unless specifically required otherwise by this section.

3.1.1.2 For vessels complying with the requirements in this section the qualifier Design will be added to the class notation Clean (meaning Clean(Design)).

3.2 Emissions to air

3.2.1 General

3.2.1.1 Compliance with the rules shall be verified by means and measures as identified in [1.6].

3.2.2 Cargo evaporation

3.2.2.1 The criteria for emissions from cargo evaporation apply for tankers carrying crude oil, petroleum products or chemicals with flash point less than 60°C. These emissions are defined as volatile organic compounds, VOC.

3.2.2.2 In order to reduce the amount of VOC generated, tankers fitted with mast risers for release of cargo vapour during loading shall be provided with means to maintain an overpressure in cargo tanks during loading. The same or a similar system shall be provided to maintain an overpressure and reduce the need for manual pressure release on laden voyage. The system shall consist of an in-line automatic pressure control valve arranged in a by-pass to the mast riser isolation valve. The automatic pressure control valve and by-pass shall have the same capacity as required for the common cargo tank venting/inert gas piping system to which it is connected and be so designed that the individual P/V-valves for each cargo tank do not open when the in-line pressure control valve is activated. Unless the maximum loading rate takes into account the setting of the in-line pressure control valve, it shall be provided with lockable means of closing when loading with vapour return to shore. The setting of the in-line pressure control valve shall be marginally below the setting of the individual P/V-valves fitted to each cargo tank, but not more than 0.03 bar below such a setting. The in-line pressure control valve shall have a low blow-down. I.e. the lowest pressure after opening (including closing pressure) shall not be more than 0.03 bar below the opening pressure.

3.2.2.3 For tankers provided with a vapour recovery process system, the in-line pressure control valve capacity may be designed for release of vapour during laden voyage only.

Guidance note:
The in-line automatic pressure control valve can be of power operated pressure control type, mechanical type (e.g. weight loaded) or similar.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.2.3 Refrigerants

Refrigerants used shall be either a natural refrigerants (e.g. NH\textsubscript{3} or CO\textsubscript{2}), or alternatively an HFC complying with:
\[
\text{GWP} \leq 2000.
\]
Environmental protection and pollution control

3.2.4 Fire fighting substances

3.2.4.1 Natural substances used in fixed fire fighting systems are not considered damaging to the atmosphere. If other substances are used in fixed fire fighting systems that may have a global warming potential, the used substance shall comply with:

- GWP < 2000
- ODP = 0.

Guidance note:
Natural substances: e.g. argon, nitrogen, water spray, high expansion foam, CO₂. Note that CO₂ in this context is considered a natural substance without ODP or GWP since it will utilise CO₂ already present in the atmosphere.

Other substances: E.g. industrial substances including Hydrofluorocarbons (HFC) and sulphur fluorides.

3.2.4.2 Fire extinguishing foam containing more than 0.001 percent by mass of perfluorooctanesulfonic acid and its derivatives (PFOS) are prohibited according to EU (Directive (EC) no. 757/2010/Directive amending the Directive (EC) no. 850/2004 - POP directive).

3.2.5 Shipboard incinerators

3.2.5.1 An incinerator for burning oil sludge and solid waste shall be installed onboard unless the vessel will have enough capacity for 100% delivery to shore.

Guidance note:
The amount of domestic, operational and cargo waste can be based on the following table:

<table>
<thead>
<tr>
<th>Domestic and operational waste</th>
<th>All types of vessels</th>
<th>3.0 kg/person/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cargo associated waste</td>
<td>Bulk carriers/obo-carriers</td>
<td>8.2 kg/day</td>
</tr>
<tr>
<td></td>
<td>Container vessels</td>
<td>1.4 kg/day</td>
</tr>
<tr>
<td></td>
<td>Ferries</td>
<td>2.0 kg/person/day</td>
</tr>
<tr>
<td></td>
<td>General cargo vessels and OSV</td>
<td>49.3 kg/day</td>
</tr>
<tr>
<td></td>
<td>Reefers</td>
<td>22.2 kg/day</td>
</tr>
<tr>
<td></td>
<td>Tankers</td>
<td>0.01 kg/day</td>
</tr>
</tbody>
</table>

3.3 Discharges to sea

3.3.1 General

3.3.1.1 Compliance with the rules in [3.3] shall be verified by means and measures as identified in [1.6]. Actual discharges shall be recorded as specified in [3.3.2] to [3.3.10].

3.3.1.2 Vessels with class notation **Tanker for chemicals** shall have integral tanks, type a2 or independent tanks complying with Pt.5 Ch.6 Sec.1 [2.4.3] to Pt.5 Ch.6 Sec.1 [2.4.6].
3.3.1.3 Vessels with class notation **Tanker for oil** with the deadweight of less than 5000 tonnes shall as a minimum have a double skin arrangement in the cargo area complying with the dimensions given in MARPOL, Annex I, Regulation 19.6. Single skin cargo wing tanks are not accepted.

3.3.1.4 Hull arrangement including cargo tanks for other vessels carrying oil-containing liquids in bulk shall comply with requirements in [3.4.1].

**Guidance note:**
This applies to e.g. supply vessels and other vessels carrying fuel oils and oil-based mud.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

### 3.3.2 Cargo handling

3.3.2.1 Tankers for oil or chemicals shall have fitted and implemented means and arrangements to reduce the likelihood of cargo spill on deck reaching the sea.

Gutter plates on both sides of the cargo deck shall be increased in height from a point 0.2 \( L \) forward of midship to a termination at the aft end of the cargo deck with the minimum heights given in Table 6.

**Table 6 Cargo deck gutter plates, minimum heights**

<table>
<thead>
<tr>
<th></th>
<th>forward of 0.2 ( L ):</th>
<th>( 0.25 ) m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessels greater than</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 000 tonnes DW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vessels smaller than</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 000 tonnes DW</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To avoid cargo flowing around the accommodation/poop deck, a transverse fishplate shall be arranged at the aft end of the cargo area. At the outer end the transverse fishplate shall have the same height as and be connected to the aft end of the gutter plate.

3.3.3 Crude oil washing -COW

3.3.3.1 The COW efficiency shall be such that coverage of minimum 96% is obtained, as documented by shadow diagrams. Guidelines for the assessment of shadow diagram given in IMO Resolution A.446(XI), as amended by resolution A.497(XII) shall be followed.

3.3.4 Arrangements for fuel oil bunkering and other oil filling systems

3.3.4.1 The high level alarm requirements given at [2.3.3.1] shall be applied to lubricating oil, hydraulic oil and other oil filling tanks as well.

3.3.4.2 Tanks with no risk of causing environmental contamination due to overfilling do not need to comply with [3.3.4.1]. Typically this applies to those small internal tanks which will be filled up locally from oil drums or their overflow vent pipes end up in engine room area.

3.3.4.3 Refuelling stations for helicopter or auxiliary vessels such as life boats, tenders or rescue boats shall be provided with arrangements whereby fuel spillage may be collected and drained to a safe location.

3.3.4.4 Spill/drip trays for oil bunkering arrangements shall be fitted with closed drainage to a deck collecting tank or a sludge tank. If the spill/drip tray is combined with the cargo manifolds area, this requirement is not applicable.

3.3.4.5 The fuel sampling equipment and procedures shall comply with the IMO guideline for sampling, Resolution MEPC.182(59).
### 3.3.5 Ballast water and biofouling

#### 3.3.5.1 Ballast water discharges from vessels shall comply with the D-2 (treatment method) standard of the Convention with amendments and guidelines.

#### 3.3.5.2 Vessels shall be provided with a biofouling management plan. It shall be approved that the plan is in accordance with MEPC.207(62).

### 3.3.6 Bilge water and oil residues (sludge)

#### 3.3.6.1 All parts of the bilge water system and sludge system, including pipes, valves, pumps and oil water filtering/separating equipment shall be fitted with labels/colour codes in order to easily identify the different piping systems in accordance with ISO 14726:2008.

#### 3.3.6.2 The bilge alarm shall be calibrated every 2.5 years at IOPP or class certificate intermediate and renewal surveys and set to 5 ppm. Calibration report for 5 ppm bilge alarm shall be available onboard for inspection all the time.

#### 3.3.6.3 Bilge water separator and bilge alarm combined with an automatic stopping device shall be provided for all vessels irrespective of size in a way that no overboard effluent contains more than 5 ppm of oil products and oil burning contaminants. The overall response time (including the response time of the bilge alarm) between an effluent discharge exceeding 5 ppm oil and to the automatic stopping device preventing the overboard discharge shall be less than 20 s.

#### 3.3.6.4 Procedures for handling drainages from machinery spaces and other spaces where the oil contaminated water may be present, such as thruster rooms, steering gear rooms, pump-rooms and spaces containing hydraulic power packs shall be included in bilge water and sludge management plan.

**Guidance note:**
For tankers, oily water transferred to slop tanks (subject to requirements to prevention of backflow of cargo vapour) may be discharged overboard through the ODME. For other oily water tanks, the discharge overboard shall be through a 5 ppm content meter with alarm with auto-stop.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

#### 3.3.6.5 The effluent for the 5 ppm bilge alarm should be capable of being returned to the bilge water tank (recycling line).

#### 3.3.6.6 The minimum total capacity of the bilge water tank(s) shall be as given in Table 7.

### Table 7 Capacity of bilge water tanks

<table>
<thead>
<tr>
<th>Main engine rating (kW)</th>
<th>Minimum capacity (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1000</td>
<td>4</td>
</tr>
<tr>
<td>Above 1000 up to 20 000</td>
<td>P/250</td>
</tr>
<tr>
<td>Above 20 000</td>
<td>40 + P/500</td>
</tr>
</tbody>
</table>

\[P = \text{main engine rating in kW}\]

For non-conventional propulsion systems (e.g. diesel-electric propulsion) without main engines, \(P\) can be considered as sum of the all auxiliary engines or the heaviest loading condition (e.g. normal sea going condition, dynamic positioning, loading, etc.).
For ships adopting IBTS and having statement of fact for compliance with MEPC.1/Circ.511, the required capacity of oily bilge water tanks may be reduced.

3.3.6.7 Bilge system of the vessel shall contain bilge settling tank in addition to bilge holding tank. Means for surface decanting leading through a hopper into the sludge tank shall be provided.

3.3.6.8 Separate tank(s) shall be provided for the collection of washing water used for soot cleaning of boilers and economizers. The water inlets to the tanks shall be provided with soot collecting filter bags or equivalent arrangement. The tanks shall be provided with piping connections as follows:
— for direct discharge to reception facility
— for transfer of surface soot and oily surface to a sludge tank or equivalent
— for transfer of settled clean water to bilge holding tank or bilge settling tank
— for discharge of settled clean water overboard.

3.3.6.9 If overboard effluent through 5 ppm bilge alarm come from multiple sources (bilge water separator, processed clean bilge water pump, etc.) then interlock shall be provided for all these sources in such a way that only one source is able to discharge overboard at one time.

3.3.6.10 The oil being discharged from the oil water separator shall be directed to an oil residue (sludge) tank.

3.3.6.11 In case any of the sludge tanks is used for evaporation of water in oil residue by means of heating, it shall be fitted with exhaust fan for ventilating the water vapour.

3.3.6.12 The sludge tanks shall be below the heavy fuel oil and lubricating oil purifiers, if installed. The pipelines from purifiers shall, wherever possible, be straight or fitted with a large radius elbow. Drain lines from sludge tanks below purifiers to the bilge tank (or, as an alternative, to the sludge tank) shall be provided with self-closing valves and hoppers.

3.3.6.13 Drain oil shall be collected through fixed drainage arrangement directly to the sludge tanks. If necessary a sludge transfer pump may be used to pump the drain oil to the sludge tank. Drip trays and coamings of sufficient height shall be provided under all equipment where oil spill may be present, such as diesel engines, burners, hydraulic motors, pumps, heaters, coolers, filters and tanks in order to collect spillage of oil.

3.3.6.14 The drip trays and coamings for equipment not fitted with closed drainage to the sludge tanks shall be collected in the oil residue collecting tank and this emptying procedure shall be incorporated into the bilge water and sludge management plan.

3.3.7 Garbage

3.3.7.1 The vessel shall be equipped and arranged for sorting, collecting, minimising and storing garbage prior to incineration or delivery to shore. Vessels shall have sufficient capacity to allow 100% delivery to shore, or incineration where permitted.

3.3.7.2 Food waste, in any form, shall not be discharged into a vessel’s sewage treatment plant. It is required that ground food waste be directed to a holding tank when the vessel is operating within an area where discharge is prohibited. If any design can show that systems can handle black/greywater contaminated with ground food, it will be acceptable as alternative to the discharge into a vessel’s sewage treatment plant.

Vessels with class notations Passenger ship or Ferry(A) (or Ferry(B)) shall not dispose any waste to sea except for food waste when having passed through a grinder or comminutor for food waste and where permitted by international and local legislation.
### 3.3.8 Sewage

#### 3.3.8.1 The vessel shall be provided with holding tanks for sewage with facilities for delivery ashore. The tanks shall have sufficient capacity for the number of persons onboard and for the anticipated time of port stay.

For estimating necessary tank capacity a minimum wastewater volume of 70 litres/day/person shall be used. For vessels using vacuum systems, a minimum wastewater volume of 25 litres/day/person shall be used. The duration of port stay shall not be assumed less than 4 days.

#### 3.3.8.2 Ballast tanks are not allowed to be used as holding tanks for treated sewage. In no case shall ballast tanks be used as holding tanks for untreated sewage.

#### 3.3.8.3 Sewage system ventilation pipes shall be independent from other ventilation piping systems.

#### 3.3.8.4 Drain from the galley shall be fitted with a grease trap. For vessels where the total number of crew and passengers normally are more than 30, drain from the galley shall be fitted with a grease trap, connected to the sludge tank or other suitable collecting tank. In cases of long distances between the grease trap and the sludge tank, heat tracing and adequate slope shall be provided.

#### 3.3.8.5 All vessels shall have procedures included in the garbage management plan for how the grease trap is emptied, either to the sludge/collecting tank and/or sent ashore.

### 3.3.9 Greywater

#### 3.3.9.1 Greywater shall be treated in the vessel's sewage treatment plant(s) unless the vessel treats greywater with a system that meets the following standard:

1. The discharge shall satisfy the minimum level of effluent quality specified in USCG 40 CFR §133.102;
2. The geometric mean of the samples from the discharge during any 30-day period may not exceed 20 fecal coliform/100 millilitres (ml) and not more than 10% of the samples may exceed 40 fecal coliform/100 ml; and
3. Concentrations of total residual chlorine may not exceed 10.0 micrograms per litre (µg/l).

**Guidance note:**
Reference to US environmental protection agency’s Vessel General Permit for Discharges Incidental to the Normal Operation of the Vessels (VGP) 2013 item 5.1.1.1.2.

---end---of---guide---n-o-t-e---

#### 3.3.9.2 The vessel shall be provided with holding tanks for greywater. The tanks shall have sufficient capacity for the number of persons onboard and for the anticipated time of port stay. For estimating necessary tank capacity a wastewater volume of 110 litres/day/person may be used. The duration of port stay shall not be assumed less than 4 days.

#### 3.3.9.3 Ballast tanks are not allowed to be used as holding tanks for greywater. Combined treated sewage and greywater holding tanks are accepted.

#### 3.3.9.4 Dedicated sewage and greywater holding tank(s) shall be fitted with high level alarm.

### 3.3.10 Stern tube lubricant and seal design

#### 3.3.10.1 For stern tubes, other than water lubricated, the design of the stern tube seal shall safeguard that the lubricant cannot get in contact with water.

If a biodegradable oil is used, an arrangement shall be in place to keep the water content of the oil under control and it shall be ensured that seal materials are compatible with the biodegradable oil.
If fossil-based-oil is used, an effective, monitored double barrier seal system shall be in place to safeguard against oil leaks to the sea.

3.3.10.2 All relevant drawings documenting the installation of lubricated stern tube arrangement shall be submitted for approval.

3.4 Construction and design

3.4.1 Oil tank protection

3.4.1.1 The requirements in [3.4.1] and [3.4.2] apply to tanks for fuel oil, lubricating oil, hydraulic oil and waste oil (sludge), including overflow tanks. Tanks with capacity below 10 m$^3$ can be located in the double bottom provided that the total capacity of these unprotected tanks will be less than 40 m$^3$. The requirements also apply to cargo tanks on vessels coming under regulation 2.2 of MARPOL Annex I.

3.4.1.2 A reduction of the required height of the double bottom under the sump tank under the main engine(s) is acceptable, if motivated by the technical design.

3.4.1.3 Individual tanks shall not have a capacity of over 1500 m$^3$.

3.4.1.4 Tanks shall be located above the moulded line of the bottom shell plating nowhere less than the distance $h$ as specified below:

$$h = \frac{B}{20}$$

or

$$h = 2.0 \text{ m}, \text{ whichever is the lesser.}$$

The minimum value of $h = 0.76$ m.

In turn of the bilge area and at locations without a clearly defined turn of the bilge, the oil fuel boundary line shall run parallel to the line of the midship flat of bottom as shown in Figure 1.

![Figure 1](image-url)
Guidance note:
For semi-submersible offshore units, it is acceptable to use $B$ as the breadth of pontoon 1+2, i.e. $B = B_{p1} + B_{p2}$.

---end-of-guidance-note---

3.4.1.5 For vessels having an aggregate oil tank capacity below 5000 m$^3$ tanks shall be located inboard of the moulded line of the side shell plating, nowhere less than the distance $w$ which, as shown in Figure 2, is measured at any cross-section at right angles to the side shell, as specified below:

$$w = 0.4 + 2.4 \frac{C}{20000} \text{ m}$$

Where $C$ is the vessels total volume of fuel oil tanks, in m$^3$, at 98% tank filling.

The minimum value of $w = 1.0$ m, however for individual tanks with an oil capacity of less than 500 m$^3$ the minimum value is 0.76 m.

![Figure 2](image)

**Figure 2**

3.4.1.6 For vessels with an aggregate oil tank capacity of 5000 m$^3$ and over, tanks shall be located inboard of the moulded line of the side shell plating, nowhere less than the distance $w$ which, as shown in Figure 2, is measured at any cross section at right angles to the side shell, as specified below:

$$w = 0.5 + \frac{C}{20000}$$

or

$$w = 2.0 \text{ m}, \text{ whichever is the lesser.}$$

The minimum value of $w = 1.0$ m.

Where $C$ is the vessels total volume of fuel oil tanks, in m$^3$, at 98% tank filling.

3.4.1.7 Combined fuel oil and water ballast tanks shall not be arranged.

3.4.1.8 The skeg shall not be considered as offering protection for the oil tanks.
3.4.1.9 For the area within the skeg's width the distance \( h \) shall be measured perpendicular to a line parallel to the baseline at the intersection of the skeg and the moulded line of the bottom shell plating as indicated in Figure 3.

![Figure 3](image1)

3.4.1.10 For vessels designed with a permanent trim, the baseline should not be used as a reference point. The distance \( h \) should be measured perpendicular to the moulded line of the bottom shell plating at the relevant frames where fuel tanks shall be protected.

3.4.1.11 For vessels designed with dead rising bottom, the distance \( 1.5h \) should be measured from the moulded line of the bottom shell plating but at right angle to the baseline, as indicated in Figure 4.

![Figure 4](image2)

3.4.2 Sundry

3.4.2.1 Lines of oil piping located at a distance from the vessel's bottom less than \( h \), as defined in [3.4.1.3], or from the vessel's side less than \( w \), as defined in [3.4.1.4] and [3.4.1.5] shall be fitted with valves or similar closing devices within or immediately adjacent to the tank. These valves shall be capable of being brought into operation from a readily accessible enclosed space the location of which is accessible from the navigation bridge or the propulsion machinery control position without traversing exposed freeboard or superstructure decks. The valves shall close in case of remote control system failure (fail to close) and shall be kept closed at sea at any time when the tank contains oil except when they may be opened during transfer operations.
3.4.2.2 Suction wells in oil tanks may protrude into the double bottom below the boundary line defined by the distance \( h \) provided such wells are as small as practicable and the distance between the well bottom and the bottom shell is not less than \( 0.5 \, h \).

### 3.4.3 Sludge tanks

3.4.3.1 Sludge tanks shall be fitted with heating arrangements to facilitate the pump-ability and discharge of the tank content.

**Guidance note:**
This is applicable to ships operating with HFO, marine diesel oil (MDO) and MGO but may not be applied to gas-fulled ships.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.4.3.2 Sufficient man-holes should be provided such that, taking into consideration the internal structure of the oil residue (sludge) tanks, all parts of the tank can be reached to facilitate cleaning.

### 3.5 Other aspects

#### 3.5.1 Ship recycling

3.5.1.1 All vessels shall hold and maintain an inventory of hazardous materials as required by *The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships* (SR/CONF/45) and any subsequent additions or amendments hereto adopted at the relevant time. The Inventory of Hazardous Materials shall be prepared using the most recent guidelines Resolution MEPC 197(62).

Vessels shall hold class notation **Recyclable**, see Sec.4 to fulfil this requirement.

**Guidance note:**
For newbuilding projects, if prior to delivery, IHM is ordered to be developed and certified according to ships in operation procedure, this requirement is fulfilled and **Recyclable** shall be assigned prior to next renewal survey.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
SECTION 3 FUEL AND LUBRICATION OIL SYSTEMS AND ARRANGEMENT FOR MEETING REGULATIONS IN EMISSION CONTROL AREAS - ECA

1 General

1.1 Introduction
The additional class notation **ECA** sets requirements to vessels fuel and lubrication oil systems and arrangement for meeting regulations in emission control areas.

1.2 Scope
The scope of the additional class notation **ECA** shall verify that the vessel is arranged to enable vessels machinery components (main propulsion plant, power generation plant and steam/thermal oil plant, inert gas plant etc.) to change between residual oil and marine distillate fuel and operate for longer periods on marine distillate fuels with very low viscosity and very low sulphur content.

1.3 Application
The additional class notation **ECA** applies to vessels arranged and equipped as required by the rules in this section. Vessels with the additional class notations **ECA** may be appended by one of the mandatory qualifiers **SOx-A** or **SOx-P** where:
- **ECA** - denotes that the vessel is adapted to operate within emission control areas.
- **SOx** - denotes that the vessel is adapted to comply with **SOx** regulations within emission control areas as per Annex VI of MARPOL 73/78 and can operate specific machinery components on marine distillate fuels with very low viscosity and sulphur content for a minimum of 4 operating days reflecting the consumption specified in [2.1.1.1].
- **A** - denotes that the vessel is designed to operate all machinery components on marine distillate fuel.
- **P** - denotes that the vessel is designed to only operate machinery components used in port on marine distillate fuel.

A vessel designed to operate all machinery components e.g. main propulsion plant, power generation plant, steam/thermal oil plant, etc. on marine distillate fuel may be given class notation: **ECA(SOx-A)**. This class notation is relevant for vessels operating e.g. within an ECA as of 1 July 2015 as per Annex VI of MARPOL 73/78.

A vessel designed to operate machinery components used in port e.g. power generation plant, steam/thermal oil plant, etc. on marine distillate fuel may be given class notation: **ECA(SOx-P)**. This class notation is relevant e.g. for vessels calling EU ports and thus required to comply with the EU low sulphur directive 2005/33/EC.

The rules are also applicable to vessels that will continuously operate on marine distillate fuels and vessels provided with approved abatement technology capable of cleaning emissions to a marine distillate fuel equivalent standard.

1.4 Definitions

1.4.1 Marine distillate fuel shall be taken to mean a fuel oil with a sulphur level not exceeding 0.10% and with a viscosity not less than 2 cSt at 40°C.
Guidance note:
Marine distillate fuel is considered equivalent to marine gas oil grade DMA and DMZ as given in ISO 8217 (latest revision), except for the sulphur and viscosity limits as stated in [1.4.1].

---e-n-d-o-f-g-u-i-d-a-n-c-e---n-o-t-e---

1.4.2 Residual oil shall be taken to mean heavy fuel oil (ISO 8217 marine residual fuels).

1.5 Documentation requirements

1.5.1 Documentation shall be submitted as required by Table 1.

Table 1 Documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel tanks</td>
<td>S030 – Capacity analysis</td>
<td>From manufacturers of machinery components ability to use marine distillate fuels e.g. engines, boilers and any fuel oil pump. Also include relevant pages from the operations and maintenance manual.</td>
<td>AP</td>
</tr>
<tr>
<td>Fuel oil system</td>
<td>Z300 – Declarations</td>
<td>Confirming the viscosity of the marine distillate fuel at the inlet of machinery components (including fuel pumps). Also indicate viscosity versus temperature variations.</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z265 – Calculation report</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z161 – Operation manual</td>
<td>Fuel oil change-over. See Sec.4.</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z268 – Assessment report</td>
<td>Hazard identification study.</td>
<td>FI</td>
</tr>
<tr>
<td>Sea and fresh water systems</td>
<td>S010 – Piping diagram (PD)</td>
<td>Chiller system for fuel cooling.</td>
<td>AP</td>
</tr>
</tbody>
</table>

AP=For approval; FI=For information

For general requirements for documentation, including definition of the info codes, see DNVGL-CG-0550 Sec.6.

For a full definition of the documentation types, see DNVGL-CG-0550 Sec.5.

1.5.2 If abatement technology is used to ensure compliance, the documentation requirements are subject to special consideration.

2 Systems and arrangements

2.1 Fuel oil tank arrangements

2.1.1 Arrangement of fuel oil storage tanks

2.1.1.1 The vessel shall be arranged with minimum one dedicated storage tank for each (e.g. low and/or high sulphur) marine distillate fuel grade carried.

The total storage tank capacity for marine distillate fuel shall be sufficient for:
— For vessels with qualifier A as given in [1.3], operating the vessel on a minimum of 4 days at 75% MCR of the main engine and for auxiliary engines, normal seagoing load as specified in Pt.4 Ch.8 Sec.2 [2.1.1] but also including load due to operation of thrusters not forming part of the main propulsion or steering, mooring, cargo handling gear and refrigerators for air conditioning. For tankers, the fuel oil capacity shall also be sufficient for the carriage of heated cargoes (if applicable) as well as minimum one cargo discharge operation (fully loaded vessel).

— For vessels with qualifier P as given in [1.3], operating the auxiliary engines for a minimum of 4 days on normal seagoing load as specified in Pt.4 Ch.8 Sec.2 [2.1.1] but including load due to operation of mooring, cargo handling gear and refrigerators for air conditioning. For tankers, the fuel oil capacity shall also be sufficient for the consumption needed to maintain the temperature of heated cargoes (if applicable) as well as minimum one cargo discharge operation (fully loaded vessel).

Guidance note:
The fuel oil capacity for one cargo discharge operation should include boiler consumption for steam turbine driven cargo pumps, additional consumption due to increased power demand during cargo discharging operations (e.g. ballast pump operation, hydraulic power packs etc.), as well as additional consumption due to inerting of cargo tanks.

Any marine distillate fuel settling tank capacity may be included in the total storage tank capacity.

2.1.1.2 Tanks for storage of marine distillate fuel shall not be located adjacent to heated tanks unless the calculations required in [2.2.1.1] confirm that viscosity in way of machinery components (including fuel oil pumps) is not below that specified in [1.4.1].

2.1.2 Arrangement of fuel oil settling and service tanks

2.1.2.1 Dedicated service and settling tanks shall be arranged for marine distillate fuels. Each service tank shall have a capacity for at least 8 hours operation. Provided that the marine distillate fuel from storage tanks are arranged for separation prior to transfer to service tanks, settling tanks for marine distillate fuels are not required.

2.1.2.2 Service and settling tanks for marine distillate fuel shall not be located adjacent to heated tanks.

2.2 Fuel oil system arrangements

2.2.1 General

2.2.1.1 Calculations shall be performed to confirm that the viscosity of the marine distillate fuel in way of machinery components (including fuel pumps for marine distillate fuel) is not lower than that specified in [1.4.1]. The calculations shall indicate viscosity as well as temperature. Calculations shall be carried out for the operational loads given in [2.1.1.1] as well as during change-over from residual oil to marine distillate fuel and vice-versa. The calculations shall take into account the environmental conditions in Pt.4 Ch.1.

2.2.2 Fuel oil service piping systems

2.2.2.1 Auxiliary engines for electric generators shall for each consumer have separate fuel oil service system piping (including required pumps, filters, etc.) from service tanks for residual oils and marine distillate fuel.

2.2.2.2 Boiler fuel service system piping (including required pumps, filters, etc.) from service tanks for residual oils and marine distillate fuel to boilers may be accepted as common provided it can be documented that the change-over time from residual oil to marine distillate fuel is less than 4 hours (taking into account minimum viscosity and maximum sulphur levels for marine distillate fuel).

2.2.2.3 For vessels with qualifier A as given in [1.3], main engine fuel service system piping (including required pumps, filters, etc.) from service tanks for residual oils and marine distillate fuel to main engines may be accepted as common provided it can be documented that the change-over time from residual oil
to marine distillate fuel is less than 4 hours (taking into account minimum viscosity and maximum sulphur levels for marine distillate fuel).

2.2.2.4 Separate supply pumps for marine distillate fuel shall be arranged with redundancy. If residual oil pumps are declared suitable for pumping marine distillate fuels at required pressure and capacity, then separate distillate pumps are not required.

2.2.2.5 All fuel oil heaters shall be provided with by-pass arrangements. Heat tracing arrangements shall be provided with means for shut-off when operating common systems with marine distillate fuel.

2.2.2.6 Fuel oil return system shall be arranged so that it is possible to return fuel from any machinery components to both marine distillate and residual oil tanks.

Guidance note:
The fuel return into clean marine distillate tanks should be active only if it is ensured that any fuel mixture is already flushed into residual tanks and clean marine distillate will flow into marine distillate tanks.

Any pollution from high sulphur residuals or fuel mixtures into the clean marine distillate tanks with very low sulphur content should be avoided.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.2.2.7 The installation of freshwater coolers or chiller systems in the fuel oil service systems are required in order to maintain the marine distillate fuel viscosity above the minimum level as specified in [1.4.1]. Cooling systems shall comply with the requirements of Pt.4 Ch.6, including redundancy requirements. Where the fuel system pressure exceeds the cooling system pressure, means for detection of leakage shall be provided e.g. high level alarms in expansion tanks.

Guidance note:
The requirement to install freshwater coolers or chiller systems will be waived when evidence is provided that the marine distillate fuel viscosity is kept above the minimum level without this arrangement.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.2.2.8 Arrangements shall be provided to prevent excessive heating of marine distillate fuel when a machinery component is in e.g. stand-by mode.

2.2.2.9 Pump relief valves shall not discharge to the suction side of pumps.

2.2.3 Fuel oil treatment piping systems

2.2.3.1 Fuel oil treatment system piping (including pumps, separators etc.) from settling to service tanks for residual oils and marine distillate fuel oils shall be separated. Separate separator supply pumps for marine distillate fuel shall be arranged with redundancy. If residual oil separator pumps are declared suitable for pumping marine distillate fuels at required pressure and capacity, then separate marine distillate pumps are not required.

2.2.4 Fuel oil transfer piping systems

2.2.4.1 Fuel oil transfer system piping (including pumps etc.) from storage tanks to settling tanks for residual oils and marine distillate fuel oils shall be separated. If residual oil pumps are declared suitable for pumping marine distillate, then separate marine distillate pumps are not required.

2.2.5 Fuel oil tanks air and overflow systems

2.2.5.1 Each air and overflow pipe from residual oil tanks and marine distillate fuel tanks are self-draining and be arranged with loops of sufficient height or equivalent arrangement, to prevent cross contamination during overflow.
2.3 Lubrication oil system arrangements

2.3.1 Lubrication oil

2.3.1.1 Vessels with cylinder lubricated engines shall be provided with two cylinder oil storage tanks. Further, for engines with a cylinder oil service tank arrangement, two cylinder oil service tanks shall be provided for each cylinder lubricated engine. The two service tanks shall be joined before the engine flange via a change-over valve.

2.3.1.2 If the equipment manufacturer specifies that system lubrication oils need to be changed when using marine distillate fuel, then the vessel shall be equipped with storage capacity for two types of system lubrication oil.

2.3.1.3 Alternative arrangements like blending with additives are acceptable, subject to special approval.

2.4 Instrumentation

2.4.1 General

2.4.1.1 The fuel oil piping systems and machinery components shall be provided with arrangements for monitoring the critical parameters in connection with change-over and operation on residual oils and marine distillate fuel. Alarms, indications and automatic controls as required for main class, as well as class notation ED (as applicable), shall be provided. In addition the monitoring functions in Table 2 are required. Systems for automatic change-over between fuel oils are not required, but are subject to approval if provided. Such automatic control systems need also to be arranged with means for manual operation and shall be fitted with by-pass arrangements.

2.4.1.2 Alarms that are only relevant when operating on marine distillate fuel shall be inhibited when operating on residual oil and vice-versa.

**Table 2 Monitoring functions**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature or viscosity at machinery component inlet</td>
<td>High (temperature) or Low (viscosity)</td>
</tr>
<tr>
<td>Level in expansion tanks in marine distillate fuel cooling systems</td>
<td>High/low</td>
</tr>
<tr>
<td>Temperature in marine distillate fuel service tanks (only when marine distillate cooling is not provided).</td>
<td>High</td>
</tr>
<tr>
<td>Pressure differential fuel filters</td>
<td>High</td>
</tr>
<tr>
<td>Level in fuel de-gassing/mixing tanks</td>
<td>High/low</td>
</tr>
</tbody>
</table>

2.4.1.3 Fuel coolers shall have automatic temperature control. Means for manual operation shall be provided.

2.4.1.4 Oil fired boiler/thermal oil heater instrumentation and control systems shall comply with the requirements of Pt.4 Ch.7 Sec.6. It shall be ensured that they can safely be run on marine distillate fuel without impairing the required boiler steam/thermal oil capacity. Operation on the different fuels shall not require manual override of or switching off the automatic control.

2.4.1.5 Oil fired burners shall be provided with a flame monitoring system that is capable of detecting the operation of any burner when operating on both residual oil and marine distillate fuel.
3 Machinery components

3.1 General

3.1.1 Machinery components

3.1.1.1 The manufacturer of machinery components shall declare that the machinery component (main engine(s), auxiliary engines, boiler(s), inert gas plant and any fuel oil pump) is capable of continuous operation on marine distillate fuel for the minimum number of operating days. Such declarations shall include details on the required modifications including details on additional equipment and arrangements, control or safety systems, as well as any possible conditions/limitations. Conditions or limitations that impair the efficiency of the change-over or impair the operation of the machinery components are not acceptable. The manufacturers’ declarations and required detailed information is subject to approval.

— Conditions/limitations related to e.g. maximum temperature increase/decrease of fuel (°C/min) to protect fuel equipment from thermal shock (expansion problems) are considered acceptable.
— Conditions/limitations related to e.g. viscosity which are in conflict with [1.4.1] are not acceptable.
— Conditions/limitations requiring continuously reduced power, machinery component load or pressure or flow when operating on marine distillate fuel are not acceptable.
— Conditions/limitations requiring substantial and time-consuming modifications to machinery components and equipment e.g. replacement of gaskets, pumps, nozzles, etc. during fuel switching are not acceptable.
— Conditions/limitations requiring changing between residual oil and marine distillate fuel burner lances are considered acceptable.

3.1.1.2 The capability of operating on marine distillate fuel with the minimum viscosity specified in [1.4.1] and associated conditions or limitations are also to be reflected in the machinery component’s operations and maintenance manuals.

4 Operational requirements

4.1 General

4.1.1 Hazard identification

4.1.1.1 For new designs or solutions, a hazard identification study shall be carried out with representatives from equipment manufacturers. The analysis shall cover all machinery components and the entire fuel system and shall include control systems. A report from the hazard identification shall be submitted to the Society.

Guidance note:
The requirement to a hazard identification study will be waived when evidence is provided that new designs or solutions do not pose any unforeseen hazards.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.1.2 Fuel oil change-over manual

4.1.2.1 An approved fuel oil change-over manual shall be available onboard and shall consist of three parts as specified below:

4.1.2.2 Part I shall cover procedures for safe and efficient change-over from marine distillate to residual oil and vice versa for all relevant machinery components and associated piping systems. It shall include the machinery component manufacturers’ instructions and declarations as well as calculations documenting
the minimum obtainable viscosity/maximum obtainable temperature of marine distillate fuel in the fuel oil systems. The procedures shall include schematic fuel oil piping diagrams and specific pipelines, valves, fuel oil equipment and machinery components. Part I is also to include procedures for safe testing of the vessels capability to operate on marine distillate fuel and in particular starting and low load operation. For the propulsion plant testing should also include manoeuvring on marine distillate fuel.

The following shall be included in a summary:

— change-over time as a function of machinery components load, and temperature differences between residual oil and marine distillate fuel during change-over
— minimum allowable viscosity of marine distillates and associated maximum allowable temperatures of marine distillate fuel in way of machinery component inlets
— maximum machinery component load at change-over from residual oil to marine distillate fuel, including duration of any load reduction
— other approved conditions/limitations given in manufacturers’ declarations
— procedures related to selection of lubrication oil based on sulphur level of fuel oil used. For cylinder lubricated engines procedures shall include e.g. feed rate reductions or change between cylinder lube oils with different total base numbers.

4.1.2.3 Part II shall cover calculations of change-over time to ensure that the fuel oil being consumed by machinery components has a sulphur content not exceeding 0.10%. This part is only relevant for vessels where the piping system for residual oil and marine distillate fuel are common.

The following parameters shall be taken into account:

— volume of piping systems (including fuel de-gassing/mixing tank) where mixing of marine distillate fuel and residual oil will occur
— residual oil sulphur content (variable)
— marine distillate fuel sulphur content (variable but not above 0.10% sulphur)
— machinery component fuel consumption during change-over
— return oil flow to fuel de-gassing /mixing tank if relevant (increasing dilution time when changing from residual oil to marine distillate fuel)
— change-over time is defined as the time from start of change-over, until the sulphur level in the fuel oil entering into machinery components is below 0.10%. If the change-over time is shorter than that presented in part I, the change-over times in part I shall still apply.

4.1.2.4 Part III shall include the following:

— contingency procedures in case of poor marine distillate fuel quality, or incompatibility between marine distillate fuel and residual oil
— contingency procedures are also to be developed for failures due to vapour lock (gasification) in the event of improper change-over sequence to distillate fuel oil
— procedures for maintaining machinery readiness for emergency departures with marine distillate fuel
— methods for monitoring cylinder condition and injection pump internal leakage after switching from residual oil to marine distillate fuel
— procedures for onboard testing of compatibility between residual oil and marine distillate fuel.

Guidance note:

It is recommended that vessels subscribe to a fuel oil testing programme with an accredited fuel testing laboratory for the purpose of verifying critical fuel oil quality parameters for marine distillate fuel and residual oils as per ISO8217 latest edition.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.1.2.5 Vessels fitted with an automatic control system for change-over between fuel oils shall include a technical specification of the system in the fuel oil change-over procedures.

4.1.2.6 For ships fitted with abatement technology the scope of the procedures will be specially considered.
5 Surveys and testing

5.1 General

5.1.1 Surveys and testing

5.1.1.1 The systems and arrangements are subject to survey and function testing after installation onboard.

5.1.1.2 A functional test shall be carried out in the presence of a surveyor to confirm safe and efficient change-over from residual oil to marine distillate fuel and continuous operation of machinery components on marine distillate fuel. The test shall confirm that the marine distillate fuel viscosities are in accordance with the calculations required in [2.2.1.1], i.e. does not exceed the min. viscosity as specified by the machinery component manufacturers. This can either be verified through viscosity measurements onboard or by verifying that the temperature before machinery components does not exceed 40°C or the value as given by maker recommendations.

The test shall as far as practicable cover all machinery components at different loads and using a marine distillate with viscosity in accordance with [1.4.1]. For all machinery components the test shall include a minimum of 4 starts as well as continuous operation on marine distillate fuels, including low load operation at 25% MCR. The duration of the test shall be sufficient to achieve steady state conditions for all operational parameters but not less than 1 hour. For reversible propulsion engines the starting test shall include manoeuvring (2 starts ahead and 2 starts astern).

Guidance note 1:
If marine distillate fuel with viscosity as per [1.4.1] is not available, it may be accepted that the temperature of the marine distillate diesel oil available is increased in the system to give a viscosity as per [1.4.1] at the machinery component inlet.

Guidance note 2:
Where it is impracticable to test all machinery components on low viscosity fuel as specified in [5.1.1.2], it may be acceptable that such functional testing is carried out by the crew and the result reported to the society. The report should include:
- specification of marine distillate fuel used
- machinery components tested
- scope of testing (see [5.1.1.2])
- machinery component loads (see [5.1.1.2])
- marine distillate fuel viscosities and temperatures at machinery component inlet
- confirmation of satisfactory result of testing.

5.1.1.3 It is required that a marine distillate fuel bunker sample is taken, tested with an accredited fuel testing laboratory and the results submitted to the society. The fuel test shall cover the quality parameters specified in ISO8217 latest edition.

5.1.1.4 For vessels where marine distillate fuel and residual oil systems are common, a functional test shall be carried out by the crew to confirm that the sulphur level before machinery components does not exceed the sulphur level of the marine distillate fuel as bunkered. The test shall be carried out after completion of change-over, see [4.1.2.3]. It is required that fuel samples are taken immediately before machinery components upon completion of change-over. The samples shall be tested with an accredited fuel testing laboratory. The fuel tests shall cover the quality parameters specified in ISO8217 latest edition. Test results shall be submitted to the Society for verification.
SECTION 4 RECYCLABLE

1 General

1.1 Introduction
In view of an increased concern on various environmental issues, focus on the use of non-hazardous materials in ship design, building and operation is increasing. Two international regulations are presently governing these issues:

New vessels flying the flag of an EU member state are required to have on board a certified inventory of hazardous materials (IHM) starting from 31 December 2018. This means that vessels with building contracts signed after this date shall have the IHM certificate in their specifications.

All EU-flagged vessels to be recycled after 31 December 2018 will be required to have a ready for recycling certificate, which means, among others, that such vessels shall only be sent to recycling facilities included in the European List of Ship Recycling Facilities (EU List).

For vessels in operation and flying the flag of an EU member state, the certified IHM is required starting from 31 December 2020.

It should be noted that the EU SRR also affects non-EU-flagged vessels, since vessels flying a third-country flag (non-EU flag) calling at a port or anchorage of an EU member state shall have a certified IHM starting from 31 December 2020.

1.2 Objective
The class notation Recyclable facilitates correct documentation of hazardous materials used on board, also supporting that the recycling process of a ship may be carried out without posing unnecessary risks to human health, safety and to the environment.

1.3 Scope
The class notation Recyclable gives specific requirements for the establishment and maintenance of inventory of hazardous materials (IHM). The scope is built on EU SRR and HKC with supporting instruments being:
— Guidelines for the development of the Inventory of Hazardous Materials, Resolution MEPC.269(68) (IHM guidelines)
— the DNV GL statutory interpretations on inventory of hazardous materials, see DNVGL-SI-0289.

The scope covers all 15 hazardous materials for IHM Part I, as stated in Annex I and II of the EU SRR.

1.4 Application
The class notation Recyclable may be used for all vessels regardless size, age, type, ownership or flag.
1.5 Class notation
Ships following the procedures and requirements laid down in these rules, may be assigned the class notation Recyclable.

Table 1 Additional class notation Recyclable

<table>
<thead>
<tr>
<th>Class Notation</th>
<th>Qualifier</th>
<th>Purpose</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recyclable</td>
<td>None</td>
<td>Inventory of hazardous materials</td>
<td>None</td>
</tr>
</tbody>
</table>

2 Documentation requirements

2.1
The documentation requirements are given in DNVGL-SI-0289.

2.2
The IHM shall be prepared in a digital format.

Guidance note:
The IHM compilation may be executed through DNV GL IGS software as the default application.

3 Procedural requirements

3.1
All vessels shall be inspected for 15 hazardous materials for IHM Part I, as stated in Annex I and Annex II of the EU SRR regardless of their flag.

3.2
The HazMat inspection method shall prioritise document check before sampling check. The IHM preparation may however be a combination of document check and inspection (sampling and testing).

3.3
The testing of hazardous material samples shall be performed by laboratories accredited according to ISO 17025, qualified for the respective test objects and methods or having specific DNV GL service supplier approval (AoSS), see DNVGL-CP-0484 App.B.
The IHM preparation shall be carried out by qualified HazMat experts and expert companies approved by the Society. Equivalent qualifications may be accepted upon agreement with the Society, see DNVGL-CP-0484 App.B.
SECTION 5 ELECTRICAL SHORE CONNECTIONS - SHORE POWER

1 General

1.1 Objective
The objective of the additional class notation Shore power is to provide requirements for a transfer of power utilizing an electrical shore connection while in port.

1.2 Scope
Additional class notation Shore power provides requirements for the design of electrical shore connections, the ship side installation of necessary equipment and the verification of the installations.

The system design comprises the following aspects:
— system functionality of the electrical shore connection as a total system. In addition, requirements to circuit breakers, earthing switches and protective functions are given
— control systems and control system interface between the shore and the vessel. Requirements are given for necessary functionality. However, the physical installations on shore are not covered by these rules
— ship side electrical equipment and installations. However, only specific requirements related to electrical shore connections are given. Generally, equipment and installations shall comply with relevant parts of Pt.4 Ch.8.

Operational characteristics and requirements with respect to power availability during loading and unloading are not within the scope of these rules.

Shore side electrical equipment and installations, apart from the functional requirements to the installation, are governed by national regulations, and are not a part of these rules. The additional class notation Shore power is not intended for shore connections used during service and maintenance docking. The requirements for those shore connections are covered by Pt.4 Ch.8.

1.3 Application

1.3.1 The additional class notation Shore power applies to vessels utilizing electrical shore connections while in port and is mandatory for vessels with high voltage shore connection and low voltage shore connection with power rating greater than or equal to 1 MVA. This is applicable for shore power supplying the distribution grid and/or charging electrical energy storage systems onboard the vessel.

Guidance note:
On request a statement of compliance may be issued by DNV GL, after successful survey, verifying that the shore power installation is compliant with the technical provisions of the IEC/IEEE 80005-series.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

1.4 Class notation
Ships complying with the requirements given in this section may be assigned additional optional class notation Shore power as specified in Table 1.
Table 1 Additional class notation Shore power

<table>
<thead>
<tr>
<th>Class notation</th>
<th>Qualifier</th>
<th>Purpose</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shore power</td>
<td>none</td>
<td>Electrical shore connection while in port</td>
<td>— Vessels with HV shore connection — Vessels with LV shore connection of a power rating greater than or equal to 1 MVA</td>
</tr>
<tr>
<td>Mandatory: yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design requirements:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[2] Pt.4 Ch.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIS survey requirements: N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.5 References

1.5.1 Requirements to electrical installations are in general described in Pt.4 Ch.8.

1.5.2 Requirements to control and monitoring systems are in general described in Pt.4 Ch.9.

1.5.3 The requirements in this section are generally based on applicable standards for ships as issued by International Electrotechnical Commission (IEC) and in particular to the IEC/IEEE 80005-series. Where reference is made to such standard, it is the edition of the standard in force at the time of contract between builder and owner that shall be applied.

1.6 Terminology and definitions

Definitions and abbreviations are given in Table 2 and Table 3.

Table 2 Definitions

<table>
<thead>
<tr>
<th>Terms</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>dedicated port</td>
<td>port where the shore power installation is custom built to support regularly attending vessels and where the shore installation is coordinated with vessel installations, e.g. ports for battery powered ferries, vessels with fast connection systems</td>
</tr>
</tbody>
</table>
| ship-to-shore interconnection system | system allowing transmission of power and electrical signals and compensating for movement generated by tide and cargo operation  

Guidance note:  
A ship-to-shore interconnection system may be a cable management system, pantograph, induction plate etc.  

---end---of---guide---note---

<table>
<thead>
<tr>
<th>Terms</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cable management system</td>
<td>equipment needed to control, monitor and handle flexible shore connection cables</td>
</tr>
<tr>
<td>safety circuit</td>
<td>electrical circuit preventing safety hazards by stopping the flow of current</td>
</tr>
</tbody>
</table>

Table 3 Abbreviations

<table>
<thead>
<tr>
<th>Terms</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
</tbody>
</table>
### 1.7 Limitations and clarifications

1.7.1 An electrical shore connection is not deemed safe to use unless the compatibility between the vessel and the shore side installation is verified for each port where the connection shall be used. Such verification is an operational matter and not covered by this class notation.

1.7.2 The availability of the shore power supply depends on the utility systems onshore. It is the obligation of the master to evaluate the criticality in case of loss of power supply, e.g. during loading and unloading operations in port.

### 1.8 Procedural requirements

#### 1.8.1 Documentation and certification

1.8.1.1 The additional class notation **Shore power** will be assigned, when the electrical shore connection system and the onboard equipment are verified and tested in compliance with these rules.

1.8.1.2 Electrical equipment installed on board for the electrical shore connection are regarded as important equipment, and shall be delivered with the Society’s product certificates as described in Table 4.

#### Table 4 Certification requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Certification standard</th>
<th>Additional description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical shore connection equipment on board</td>
<td>PC, TA</td>
<td>Society</td>
<td>[2] and Pt.4 Ch.8</td>
<td>The electrical equipment shall be certified as outlined in Pt.4 Ch.8 Sec.1 Table 3.</td>
</tr>
<tr>
<td>Cable management system</td>
<td>PC</td>
<td>Society</td>
<td>[2.4]</td>
<td>Applicable when the cable management system is installed onboard the vessel.</td>
</tr>
</tbody>
</table>

1.8.1.3 Onboard survey shall be performed as part of the verification process as described in [1.8.3].

#### 1.8.2 Documentation requirements

1.8.2.1 System design

Documentation shall be submitted as required by Table 5. The documentation will be reviewed by the Society as a part of the class contract.

Additional documentation may be required, depending on the chosen technical solution.
Table 5 System design, documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E010 - Overall single line diagram</strong></td>
<td>Including system earthing for the electric shore connection.</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td><strong>E050 - Single line diagrams/ consumer list for switchboards</strong></td>
<td>Electrical documentation of switchboards and switchgear installed as part of the electrical shore connection system and the cubicle in the main switchboard associated with the electrical shore connection (including switchboard layout and arrangement drawings, and schematics with information on protection, synchronisation, breaker interlocks, undervoltage trips, emergency disconnection and remote control circuits as relevant).</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td><strong>E040 - Electrical load balance</strong></td>
<td>Design values for power consumption and available power for operational modes utilising the electrical shore connection. The load balance shall reflect the operational modes stated in the system philosophy.</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td><strong>E220 - Electrical system philosophy</strong></td>
<td>An overall description of the electrical shore connection system and operating philosophy for all relevant operating modes. See [2.1.1].</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td><strong>E200 - Short-circuit calculations</strong></td>
<td>The design values for the maximum and minimum short-circuit power from the shore side shall be described.</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td><strong>E080 - Discrimination analysis</strong></td>
<td>The selectivity on board the vessel while fed from the electric shore connection shall be described, if applicable.</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td><strong>Z030 - Arrangement plan</strong></td>
<td>Including locations of on-board equipment and main cable routing for the electrical shore connection system.</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td><strong>I020 - Control system functional description</strong></td>
<td>Functional description including description of instrumentation, interlocks, monitoring and alarms.</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td><strong>Z160 - Operation manual</strong></td>
<td>A document intended for regular use on board, providing information on: operation modes, operating instructions, procedures, and details of the user interface.</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td><strong>Z254 - Commissioning procedure</strong></td>
<td>See [2.7.1].</td>
<td></td>
<td>AP, L</td>
</tr>
<tr>
<td><strong>Z264 - Commissioning Report</strong></td>
<td>See [2.7.1]</td>
<td></td>
<td>FI, L</td>
</tr>
</tbody>
</table>

AP = For approval; FI = For information; L = Local handling

1.8.2.2 Component documentation
Documentation shall be submitted as required by Table 6. The documentation will be reviewed by the Society as a part of certification.
Table 6 Component documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical shore connection equipment onboard</td>
<td>See Pt.4 Ch.8 Sec.1 [2.2.2]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable management system</td>
<td>E120 - Electrical data sheet, general</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>E140 - Assembly schedule and technical data</td>
<td>Current and voltage ratings of the cable management systems, de-ratings factors, if any.</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>E150 - Strength calculation with respect to short-circuit</td>
<td>Short-circuit rating to verify that the equipment will withstand the short-circuit power provided by the shore installation.</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>E160 - Internal arc withstanding report</td>
<td>Where applicable, otherwise installation restricts may apply.</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>E170 - Electrical schematic drawings</td>
<td>Showing main, auxiliary and control circuits.</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>E240 - Electrical assembly functional description</td>
<td>Functional description in respect to the intended application, e.g.: tension control, cable pay-out.</td>
<td>FI</td>
</tr>
</tbody>
</table>

AP = For approval; FI = For information

1.8.2.3 For general requirements for documentation, including definition of the info codes, see DNVGL-CG-0550 Sec.6.

1.8.2.4 For a full definition of the documentation types, see DNVGL-CG-0550 Sec.5.

1.8.3 Survey and testing requirements

1.8.3.1 The onboard installation and equipment shall be verified as described in section [2.7].

1.8.3.2 Tests additional to the ones described in the approved test programme may be required by the Society on a case-by-case basis.

2 Technical requirements

2.1 General

2.1.1 Shore connection system design

2.1.1.1 The design intent of the shore connection system shall be described in the system philosophy document in context with the application such as:

— supplying a vessel while at berth in different harbours, using a standardised IEC/IEEE 80005-series shore connection supply system
— charging energy storage systems onboard a vessel or supply a vessel in dedicated ports
— supplying a vessel during off-hire or lay-off.
2.1.1.2 The electrical system philosophy document shall address the specific characteristics and limitations/ restrictions of the ship’s installation.

**Guidance note:**
Specific characteristics, limitation and restriction may be:

— selectivity
— plug and socket arrangements
— switchboard arrangement and location
— HV earthing switch arrangement
— cable management.

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2.1.1.3 The system philosophy document shall include the following information:

1) minimum and maximum prospective short-circuit current
2) nominal ratings of ship’s shore connection system (voltage, frequency and current) and variations (transient and steady state)
3) steady state and transient load demands and maximum loadstep while connected to shore power
4) short-circuit capacity levels
5) ship’s system earthing
6) safety circuit arrangements
7) maximum inrush current
8) equipotential bonding design
9) black-out recovery, see [1.7.2]
10) selectivity/protection coordination while supplied with shore power.

2.1.2 Black-out recovery

2.1.2.1 Where a black-out of the vessel while on shore power supply creates a critical situation for passengers, crew or cargo operation, at least one source of main electrical power shall be in standby.

2.1.3 Voltage and frequency

2.1.3.1 When a vessel is powered by shore power supply, the system voltage and frequency of the shore utility supply shall match the system voltage and frequency of the vessel unless the design is made to enable different voltages and frequencies to be used.

**Guidance note:**
In order to allow standardization of shore connections, nominal voltage levels have been defined in IEC/IEEE 80005-series such as 400 V AC, 440 V AC, 690 V AC, 6.6 kV AC and/or 11 kV AC. This doesn't preclude the use of other voltage levels and frequency for dedicated shore connection systems.

A system design where parts of the vessel’s consumers are powered by a shore connection with a different frequency than the nominal frequency of the vessel is acceptable (e.g. reefer load powered by 50 Hz shore power on a 60 Hz vessel). Also a system design with two electrical shore power connections, one with 50 Hz, and one with 60 Hz, is acceptable.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.1.4 System earthing and protective earthing

2.1.4.1 The vessel’s designed earthing system shall be maintained in electrical shore connection operation. The selected design solution shall be described in the system documentation.

2.1.4.2 A conductor for protective earthing shall be connected between the vessel’s hull and the shore ground. Earth fault protection shall disconnect the shore power supply, both the shore side circuit breaker and the vessel’s shore connection switchboard circuit breaker.
2.1.4.3 Conductors used for system earthing or protective earthing shall be dimensioned so that they can carry the current that will flow in a worst case failure scenario.

2.1.5 Galvanic isolation

2.1.5.1 For electrical shore connections, the shore side distribution system and the vessel’s distribution system shall be galvanically separated. When this separation is performed by a transformer, the transformer shall have separate windings for the primary and the secondary side. The transformer may be installed either on shore, or on board.

**Guidance note:**
In order to allow standardization of the isolation transformer location as described in IEC/IEEE 80005-series, the transformer should be located on the shore side. This doesn’t preclude other solutions.

---end---of---guide---note---

2.1.6 System protection

2.1.6.1 All circuit breakers and cables used for the electrical shore connection shall be rated for the prospective short-circuit currents that may appear at their location in the installation. Interlocks shall be provided in switchboards against simultaneously feeding from the ship’s own generators and the electrical shore connection when the parallel connected short-circuit power exceeds the switchboards’ short-circuit strength. However, a short time parallel feeding is accepted when arranged with automatic disconnection of one of the parallel feeders within 30 seconds.

2.1.6.2 The electrical shore connection system may only be used when the short-circuit power from shore supply network gives prospective short-circuit currents that are not above the rated short-circuit making and breaking capacities for switchgear installed in the ship’s distribution system and large enough to isolate a possible short-circuit in the ship’s distribution system.

**Guidance note:**
In order to allow standardization of shore connections, IEC/IEEE 80005-series defines short-circuit withstand rating for shore connection equipment for different vessel types at a minimum of $I_{CW}=16$ kA/1 sec or $I_{CW}=25$ kA/1 sec. This doesn't preclude the use of other short-circuit withstand level for dedicate shore connection systems.

---end---of---guide---note---

2.1.6.3 The short-circuit protection of equipment and cables between the shore side supply circuit breaker and the ship side shore power incoming circuit breaker shall be performed by short-circuit protection on both sides of the electrical shore connection.

2.1.6.4 Limitations in the selectivity shall be described in the system philosophy.

**Guidance note:**
IEC/IEEE 80005-series defines selectivity requirements when supplied from shore.

---end---of---guide---note---

2.2 Switchgear and interlocks

2.2.1 Switchgear

2.2.1.1 A shore connection switchboard shall be provided as close as possible to the ship-to-shore interconnection system.

2.2.1.2 A shore connection switchboard may be omitted in the following cases:
— On vessels connecting in dedicated ports, where the protection coordination includes the shore and ship installation for shore power.
— Where protection against short-circuit and over-current covers the cabling between ship-to-shore interconnection system and a switchboard. A detection of a short-circuit or over-load shall open the safety circuit.
— Where the cable length from the ship-to-shore interconnection system to a switchboard is less than 10 meters.

2.2.1.3 Electrical shore connection systems shall be equipped with circuit breakers suitable for isolation and interruption of possible short-circuit currents.

2.2.1.4 The circuit breakers shall be equipped with under-voltage, overcurrent and short-circuit trip functions.

2.2.1.5 High voltage electrical shore connection systems shall be equipped with earthing switches at both sides of the cable connecting the shore to vessel enabling safe discharge of the cable and safe handling of the plug and socket.

2.2.1.6 The earthing switches shall not be opened before healthy connection of plug and socket is confirmed. Conversely, access to the plug and socket shall only be possible when the earthing switch is closed.

2.2.1.7 Closing of the circuit breakers shall not be possible unless the earthing switches are confirmed open.

2.2.2 Protection and interlocks

2.2.2.1 Circuit breakers and earthing switches in high voltage installations that are part of the electrical shore connection system, shall be incorporated into the safety circuits. These interlocks shall be described in the functional descriptions.

2.2.2.2 The safety circuits shall contain all necessary interlocking signals and permission to support a safe connection, operation and disconnection of the shore power supply.

2.2.2.3 The incoming shore power circuit breaker in the main switchboard shall be interlocked against closing unless a check synchronising relay accepts closure, or unless all generator circuit breakers in the main switchboard are in open position.

2.2.2.4 The incoming shore power circuit breaker and the shore side supply circuit breaker shall be provided with the following protection and interlocks:

a) Automatic opening of both shore-side and ship-side circuit breakers:
   — upon 2nd stage alarm for mechanical tension of shore connection cable
   — by missing confirmation of healthy protective earthing connection, where a continuous bond monitoring system is utilized
   — by missing pilot contact confirmation that the plug and socket is properly connected
   — by emergency disconnection signal
   — short-circuit and overcurrent detection on either side of the shore connection cable
   — by earth failure detection (maybe selective towards disconnection of earth failures in the on-board distribution system)
   — under-voltage detection on either side of the electrical shore connection.

b) Operation of the plug and socket:
   — when the plug and socket is manually operated, an attempt to open the plug shall automatically initiate opening of the circuit breakers in both ends of the connection.

2.2.2.5 There shall be an interlock preventing closing of shore side and ship’s shore connection circuit breaker unless plug and socket is correctly connected and earthing switches on both shore-side and ship-side are opened.
2.2.2.6 An attempt to insert or withdraw the plug shall initiate opening of circuit breakers. For automatically operated plug and socket, the same feature shall be implemented in the control system.

2.2.2.7 Closure of circuit breakers shall not be possible if confirmation of proper protective earthing connection is not confirmed.

2.2.2.8 Activation of protective functions (including high cable tension and emergency disconnection) shall give an alarm to a continuously manned location.

2.3 Emergency disconnection

2.3.1 General

2.3.1.1 An independent system for emergency disconnection shall be arranged with emergency stop push buttons.

2.3.1.2 There shall be one emergency stop button in each of the following locations:
— at the ship’s side where the plug and socket are located
— where the ship-to-shore interconnection system is located
— at the shore connection switchboard, and at a continuously manned location.

2.3.1.3 Activation of emergency stop shall result in disconnection of circuit breakers and closing of earthing switches. A manual operation of the earthing switches is permissible provided this has been addressed in [2.1.1.2].

2.3.1.4 Opening, or release, of the plug and socket may be a manual operation.

2.4 Ship-to-shore interconnection systems

2.4.1 General

2.4.1.1 Safety of the personnel while connecting, operating and disconnecting of shore connection shall be assured by the design, construction, choice of components and their place of installation along with a proper interlocking system.

2.4.1.2 Ship-to-shore interconnection systems shall be able to compensate for tidal movement and movements due to cargo operation.

Guidance note:
Compensation for tidal and cargo movement may be achieved by the on-shore equipment.

2.4.2 Flexible connection with cables

2.4.2.1 Equipment enabling safe cable handling and connection shall be installed.

2.4.2.2 The shore connection cable shall be connected by plug and socket connection. Plugs and sockets shall be designed in such a way that incorrect connection is not possible.

2.4.2.3 Connection or opening of the plug and socket while energized shall not be possible.

2.4.2.4 The plugging and unplugging of the high voltage plug connection shall be possible only when both sides are isolated and earthed.
2.4.2.5 The plug and socket system shall be of a type tested design according to IEC 62613-1 or IEC 60309-1 and suitable for marine use.

**Guidance note:**
IEC 62613-2 and IEC 60309-5 describes compatibility and interchangeability requirements for plugs and socket-outlets, ship connectors and ship inlets to allow standardization of shore connections as described in IEC/IEEE 80005-series.

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2.4.2.6 Plug and socket systems shall include pilot contacts for verification of correct insertion of plug and socket. These pilot contacts shall be used for interlocks as part of the safety circuit.

2.4.2.7 Flexible cables shall be terminated close to the ship’s side, and not be used as a part of the fixed cable installations in the vessel.

2.4.3 Cable management system
Requirements of this subsection are applicable to vessels where the cable management system is installed onboard.

2.4.3.1 A cable management system shall ensure that the mechanical tension in the ship-to-shore cables are maintained within the design parameters of the cables. The cables shall never have too much slack, nor be stretched beyond its design limits.

2.4.3.2 The cable management system shall have a two-stage alarm for high cable tension. The first stage shall alert to a manned position. The second stage shall automatically disconnect the shore connection. Automatic release of the plug and socket connection is not required. The two-stage alarm for high cable tension may be omitted where an active cable tension system is installed.

2.4.3.3 The cable management system shall give an alarm when maximum pay-out of the cable is reached (e.g. two turns remaining on the reel) and give a trip alarm when maximum pay-out of cable is exceeded.

2.4.3.4 Storage of the cable management system shall be in a weather protected area.

2.4.4 Movable shore connection container

2.4.4.1 The requirements of [2.4], except for [2.4.1.2], [2.4.3.2] and [2.4.3.3], are applicable for the connection between a movable shore connection container and the vessel.
2.5 Control and monitoring

2.5.1 General

2.5.1.1 A control system shall be arranged on board the vessel for the electric shore connection system.

2.5.1.2 This system shall trip both shore side circuit breaker and ship’s shore connection circuit breaker in case of activation of any protections and interlocks as per [2.2.2.2].

2.5.1.3 The control system shall prevent the shore side circuit breaker to close until permission is given from the ship. This permission shall not be possible to send unless correct protective earthing, plug/socket connection, and open onboard earthing switch are verified.

2.5.1.4 On the ship side of the electric shore connection systems, at the control position for the shore power incoming circuit breaker, the following instrumentation shall be installed:

- phase sequence indicator
- frequency meters for ship and shore power
- voltmeter
- ampere meter in each phase or fitted with ampere meter switch
- synchronisation equipment
- active power meter, if manual load transfer is possible.

2.5.1.5 At all locations from where the electrical shore connection or cable management system may be controlled, the following alarms and controls shall be available:

- high and high-high tension of the flexible cable
- loss of shore power
- emergency disconnection
- activation of protective functions as earth fault, overcurrent and short-circuit.

2.6 Installation

2.6.1 General

2.6.1.1 The onboard electrical installations for the electrical shore connection system shall comply with the installation requirements given in Pt.4 Ch.8 Sec.10.

2.6.1.2 All high voltage equipment shall be marked with high voltage warning sign.

2.6.1.3 A flexible shore connection cable may be arranged either on board the vessel or situated at the quay. In both situations a cable handling system shall be arranged.

2.6.1.4 All fixed cables installed on board shall be type approved or case by case approved by the Society as per Pt.4 Ch.8 Sec.1 [2.3].
2.7 Testing

2.7.1 Testing requirements
Tests described in sub-section [2.7.1.1] to [2.7.1.7] shall be conducted by designated persons or parties involved, familiar with the shore power installation. A final test report addressing the requirements of this paragraph including test results, set-points and findings shall be compiled after completion of the tests and presented to the attending DNV GL Surveyor.

2.7.1.1 Before an electrical shore connection installation is put into service or considered ready for operation, it shall be inspected and tested. The aim for this testing shall verify that the physical installation is correct. The installation shall be verified in accordance with relevant documentation. There shall be no hazard to personnel, no inherent fire hazard, and the installation shall function as required for the safe operation of the vessel. This also applies after modifications and alterations.

2.7.1.2 It shall be verified that all equipment is suitably installed with respect to ventilation, ingress protection and accessibility.

2.7.1.3 All equipment shall be verified with respect to proper installation of external wiring and protective earthing.

2.7.1.4 After installation, and with the termination kit applied, the high voltage cables shall be subject to high voltage tests as described in Pt.4 Ch.8 Sec.10 [4].

2.7.1.5 All outgoing power circuits from switchboards (cables and consumers) connected during installation shall undergo insulation resistance testing to verify its insulation level towards earth and between phases where applicable (i.e. switchboards assembled on board). The insulation resistance tests (megger tests) shall be carried out by means of a suitable instrument applying a DC voltage according to Pt.4 Ch.8 Sec.10 Table 5.

2.7.1.6 Function tests shall be performed in order to evaluate that the installation complies with the requirements in these rules. The function testing shall verify that required interlocks are working properly.

2.7.1.7 Testing of equipotential bonding between ship's hull and shore earthing system shall be performed by one of the two following options:
— verification/testing of the continuous equipotential bonding monitoring system, when installed
— initial measurement of the bonding connection resistance on board the vessel.
SECTION 6 UNDERWATER NOISE EMISSION - SILENT

1 General requirements

1.1 Introduction
For some vessels hydro-acoustic transducers are important tools for operating the vessel efficiently. For all vessels noise emission is considered an environmental disturbance. The additional class notation Silent ensures that vessels with a need for a controlled underwater noise emission can be designed and tested towards technically realistic requirements.

1.2 Scope
The additional class notation Silent specifies requirements, operating conditions and measuring methodology for vessels that need to demonstrate controlled underwater noise emission for operational purposes or in order to reduce environmental disturbance.

1.3 Application
The additional class notation Silent applies to underwater noise radiation from vessels to ensure a low environmental impact and/or to ensure hydro-acoustic operational capability for vessels relying on hydro-acoustic equipment as an important part of their operation.

1.4 Class notations

1.4.1 Vessels fulfilling the requirements and which are classed with the Society may be given the additional class notation Silent, where qualifiers for the type of requirements satisfied, will be placed in brackets after the class notation. The requirements differ depending on required operational capability and/or controlled environmental noise emission.

Guidance note:
Vessels fulfilling the requirements in this section, but is not classed with the Society may be given a certificate of compliance.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

1.4.2 The requirements for underwater noise levels are specified for four types of specific operations; acoustic, seismic, fishery, research and in addition one general notation for controlled environmental noise emission applicable for all vessels.

1.4.3 A vessel satisfying the requirements for several qualifiers may have a combination of qualifiers, e.g. Silent(A, E) denotes a Silent class for acoustical operations as well as having a controlled environmental noise emission.

Silent(A) = vessel using hydro-acoustic equipment
Silent(S) = vessel engaged in seismic research activities
Silent(F) = vessel performing fishery activity
Silent(R) = vessel engaged in research or other noise critical operations
Silent(E) = any vessel wanting to demonstrate a controlled environmental noise emission.
1.5 Definitions

1.5.1 Definitions

1.5.1.1 Sound pressure level:

\[ L_p = 10 \log_{10} \left( \frac{P_{\text{r.m.s.}}}{P_{\text{ref}}} \right)^2 = 20 \log_{10} \left( \frac{P_{\text{r.m.s.}}}{P_{\text{ref}}} \right) \text{dB re.} 1 \mu \text{Pa} \]

where:

\[ P_{\text{r.m.s.}} = \text{root mean square sound pressure (Pa)} \]
\[ P_{\text{ref}} = \text{reference r.m.s. sound pressure (1μ Pa)}. \]

1.5.1.2 Radiated noise level: \( L_{RN} = L_p \) at 1 meter (back calculated from a far-field sound pressure level measured at a known distance using the distance correction of [1.5.1.5]) dB re. 1μ Pa \cdot m

1.5.1.3 Sound spectrum level:

\[ L_{ps} = L_p - 10 \log_{10} \Delta f \text{ dB re.} 1\mu \text{Pa} 1\text{Hz} \]

where:

\[ \Delta f = \text{the bandwidth of the measured data in Hz}. \]

1.5.1.4 Radiated noise spectrum level:

\[ L_{RNs} = L_{RN} - 10 \log_{10} \Delta f \text{ dB re.} 1\mu \text{Pa} 1\text{Hz m} \]

1.5.1.5 Distance correction: correction added to a measured far-field level to derive a radiated noise level:

\[ X \log_{10} \left( \frac{r}{r_{1m}} \right) \text{dB} \]

where:

\[ X = 20 \text{ for perfect spherical spreading, 10 for cylindrical spreading}. \]
\[ r = \text{distance between vessel reference point and hydrophone in meters}. \]
\[ r_{1m} = 1 \text{ meter reference distance}. \]

**Guidance note:**

\[ X \text{ will in practical measurement cases attain a value depending on the actual acoustic field.} \]

---end---of---guidance---note---

1.5.1.6 Vessel reference point: Point on the vessel from which the distances are defined. The vessel reference point is located transversely at the vessel centreline, longitudinally a quarter-length forward of the stern and vertically at the height of the sea surface.

1.5.1.7 Closest point of approach (cpa): Shortest distance between hydrophone and vessel reference point during a pass-by test.
1.5.1.8 1/3 octave bands: The logarithmic frequency interval between a lower frequency $f_1$ and a higher frequency $f_2$ when $f_1 / f_2 = 2^{1/3}$. For practical purposes the bandwidth of a 1/3 octave band is equal to 0.23 $f_c$, where $f_c$ is the centre frequency of the band. Preferred 1/3 octave band centre frequencies are defined in IEC 61260.

1.6 Procedural requirements

1.6.1 Documentation requirements

1.6.1.1 Documentation shall be submitted for approval as required by Table 1.

Table 1 Documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
</table>
| Noise  | Z255 – Measurement procedure | For underwater noise, including:  
— Geographical location for planned measurements (several alternatives may be presented).  
— Description of depths at measuring site and bottom condition (nautical draft/map or similar).  
— Description of planned measurement set-up. I.e. location of hydrophone(s), planned sailing path(s) for vessel and details of instrumentation to be used.  
— Description of the expected operating profile for the vessel, i.e. expected time at different operating conditions when in normal service.  
— Detailed intended operating conditions for the vessel during the measurements, i.e.: Rotational speed, pitch and load of any propeller / thruster at test condition. Rotational speed and load of any engine to be used during the test. Estimated vessel speed through water.  
— If the vessel will be towing an object, type of object, calculated towing force and method of calculation of towing force.  
— Description of method(s) to be used for monitoring operating conditions.  
— Expected loading condition during the measurements and normal range of loading conditions for the vessel.  
— Description of any intended deviations from the required measuring procedure, operating conditions or loading conditions. | AP |
## Environmental protection and pollution control

### Z241 – Measurement report

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For underwater noise including:</td>
<td>Measured radiated noise levels plotted against the criterion in graphical form.</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Measured radiated noise levels in numerical form for each 1/3 octave band and overall radiated noise level for the seismic Underwater Silent notation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Detailed observed operating conditions during the tests, i.e. rotational speed, pitch and load of any propeller / thruster in use. Rotational speed and load of any engine in use. Vessel speed over ground and through water. Depth at the measuring site. Weather conditions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Graphical description of measuring site and location of hydrophone(s).</td>
<td></td>
</tr>
</tbody>
</table>

AP = For approval

### 1.6.1.2 For general requirements to documentation, including definition of the info codes, see DNVGL-CG-0550 Sec.6.

### 1.6.1.3 For a full definition of the documentation types, see DNVGL-CG-0550 Sec.5.

### 1.6.2 Normative references

#### 1.6.2.1 This section and DNVGL-CG-0313 Sec.2 contain references to the publications listed in Table 2.

### Table 2 External documents

<table>
<thead>
<tr>
<th>Document code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 60942</td>
<td>Electroacoustics - Sound calibrators</td>
</tr>
<tr>
<td>IEC 61260-1</td>
<td>Electroacoustics - Octave-band and fractional-octave-band filters - Part 1: Specifications</td>
</tr>
<tr>
<td>IEC 61672-1</td>
<td>Electroacoustics - Sound level meters - Part 1: Specifications</td>
</tr>
<tr>
<td>IEC 61672-2</td>
<td>Electroacoustics - Sound level meters - Part 2: Pattern evaluation tests</td>
</tr>
<tr>
<td>ISO/IEC 17025</td>
<td>General requirements for the competence of testing and calibration laboratories</td>
</tr>
<tr>
<td>ISO 17208-1</td>
<td>Underwater acoustics - Quantities and procedures for description and measurement of underwater sound from ships - Part 1: Requirements for precision measurements in deep water used for comparison purposes</td>
</tr>
<tr>
<td>ISO 18405</td>
<td>Underwater acoustics - Terminology</td>
</tr>
<tr>
<td>ICES Cooperative Research Report no. 209 - ISSN 1017 6195</td>
<td>Underwater noise of research vessels, review and recommendations, May 1995</td>
</tr>
</tbody>
</table>

These normative references are cited at appropriate places in the text. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document including any amendments applies.
2 Underwater noise

2.1 General

2.1.1 Rule applications

2.1.1.1 The rules specify requirements for maximum underwater noise emission for a given set of operating conditions. Compliance with the rules shall be demonstrated by measurements following the procedures specified in this section.

Guidance note:
Deviations from the requirements may be accepted upon assessment by the Society. Accepted deviations will be noted in the appendix to the class certificate or in the certificate of compliance.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.2 Underwater noise requirements

2.2.1 General

2.2.1.1 The maximum allowable noise levels for the various operations are shown in Figure 1 – Figure 5 and summarised in Table 3. The operating conditions for which the maximum noise levels apply are given in [3.1.3] – [3.1.7].

2.2.1.2 The noise limits are stated in 1/3 octave bands.

Guidance note:
It is recommended to carry out calculations at an early project stage in order to ensure that the design includes necessary low noise features and that noise control measures are integrated in the construction if necessary.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.2.2 Acoustic (A) requirements

2.2.2.1 Maximum allowable noise levels are specified in Figure 1 for two conditions, one thruster condition, and one light survey condition:

Guidance note:
Only vessels designed to use side thrusters during an acoustical survey need to satisfy the thruster condition requirements. Air bubbles will reduce the efficiency of acoustical equipment through added attenuation. Deteriorated performance due to air bubbles is not considered by these rules.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
2.2.3 Seismic (S) requirements

2.2.3.1 For vessels with power > 3 000 kW / shaft, the allowable noise level for class assignment shall be increased by 20 log (distance in meters to first hydrophone group/250) dB when the distance to the first hydrophone group exceeds 250 m.

Guidance note:
The appendix to the class certificate will state the minimum spacing between vessel and streamer used to derive the allowance.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
Figure 2 Maximum allowable noise levels for seismic survey vessels, Silent(S).

In addition to the 1/3 octave band levels of 168 dB re.1µ Pa·m, the overall rms noise level in the frequency range 3 – 300 Hz should not exceed 175 dB re.1µ Pa·m.

**Guidance note:**
The requirements have been derived based on an assumed distance from the vessel to the first hydrophone groups of 250 m and transmission loss approaching spherical dispersion. For streamers with longer distance to the first hydrophone group the noise will reduce progressively by 20 log (distance in meters/250) dB.

---end---of---g-u-i-d-a-n-c-e---n-o-t-e---
2.2.4 Fishery (F) requirements

2.2.4.1 Maximum allowable noise levels are specified in Figure 3 for two conditions, one heavy towing condition/trawling, and one light search/fish finding condition:

![Figure 3 Maximum allowable noise levels in 1/3 octave bands for fishery Silent(F).](image)

2.2.5 Research vessel (R) requirements

2.2.5.1 Maximum allowable noise levels are specified in Figure 4 and are based on the recommendations in ICES Cooperative Research Report no. 209, but are modified for frequencies below 25 Hz.
Figure 4 Maximum allowable noise levels in 1/3 octave bands for research vessels Silent(R).
2.2.6 Environmental (E) requirements

2.2.6.1 Maximum allowable noise levels are specified in Figure 5 for two conditions, a normal transit condition and a quiet cruise condition:

![Environmental (E) noise levels diagram](image)

**Figure 5** Maximum allowable noise levels in 1/3 octave bands for environmental class notation Silent(E).

**Table 3** Summary of criteria

<table>
<thead>
<tr>
<th>Operational group</th>
<th>Criteria in dB re. 1µ Pa·m</th>
<th>Frequency range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Acoustic</td>
<td>Light survey: 156 – 12 log f(kHz)</td>
<td>1 kHz – 100 kHz</td>
</tr>
<tr>
<td>A. Acoustic</td>
<td>Thruster condition: 165– 12 log f(kHz)</td>
<td>1 kHz – 100 kHz</td>
</tr>
<tr>
<td>S. Seismic</td>
<td>168 in each 1/3 octave band</td>
<td>3.15 Hz – 315 Hz</td>
</tr>
<tr>
<td>S. Seismic</td>
<td>175 integrated over the frequency range</td>
<td>3.15 Hz – 315 Hz</td>
</tr>
<tr>
<td>F. Fishery</td>
<td>Light search: 162 – 6 log f(Hz)</td>
<td>10 Hz – 100 Hz</td>
</tr>
<tr>
<td>F. Fishery</td>
<td>Light search: 138 + 6 log f(Hz)</td>
<td>100 Hz – 1 000 Hz</td>
</tr>
<tr>
<td>F. Fishery</td>
<td>Light search: 156 – 13.2 log f(kHz)</td>
<td>1 kHz – 100 kHz</td>
</tr>
<tr>
<td>F. Fishery</td>
<td>Heavy towing: 178 – 8 log f(Hz)</td>
<td>10 Hz – 100 Hz</td>
</tr>
</tbody>
</table>
3 Measurements and testing

3.1 General

3.1.1 Measurement procedures

3.1.1.1 The underwater noise emission for a vessel aiming to achieve one of the Silent notations or a certificate of compliance shall be verified through measurements complying with the requirements specified below.

3.1.1.2 The measurements shall be executed by a company approved by the Society or by the Society. In the former case, the measurements shall be witnessed by a surveyor representing the Society.

Guidance note:
The company should be able to demonstrate proven capability in underwater noise measurements and should be in possession of necessary high precision instrumentation.

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3.1.1.3 The underwater noise levels shall be measured at a noise range or at a suitable site which shall be approved by the Society before the measurements are initiated.

3.1.1.4 The measurements shall follow one of the procedures given in DNVGL-CG-0313 Sec.2.

Guidance note:
Exemption from [3.1.1.4] may be granted by the society based upon approval of procedures adopted by a permanent noise range as well as track records.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.1.2 Test conditions

3.1.2.1 A plan for the required operating conditions shall be submitted to the Society for approval prior to the testing. The plan shall at least contain the information specified in Table 1.

3.1.2.2 The operating conditions for the vessel under test shall adhere to the requirements given in one or more of subsections [3.1.3], [3.1.4], [3.1.5], [3.1.6] or [3.1.7] depending on the type of operation for which the vessel shall be tested.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

### Table 1: Criteria for underwater noise emission

<table>
<thead>
<tr>
<th>Operational group</th>
<th>Criteria in dB re. 1µ Pa·m</th>
<th>Frequency range</th>
</tr>
</thead>
<tbody>
<tr>
<td>F. Fishery</td>
<td>Heavy towing: 162 in each 1/3 octave band</td>
<td>100 Hz – 1 000 Hz</td>
</tr>
<tr>
<td>F. Fishery</td>
<td>Heavy towing: 162 – 15 log f(kHz)</td>
<td>1 kHz – 100 kHz</td>
</tr>
<tr>
<td>R. Research</td>
<td>171.8 – 22.5 log f(Hz)</td>
<td>10 Hz – 25 Hz</td>
</tr>
<tr>
<td>R. Research</td>
<td>128.7 + 8.3 log f(Hz)</td>
<td>25 Hz – 1 000 Hz</td>
</tr>
<tr>
<td>R. Research</td>
<td>153.6 – 12 log f(kHz)</td>
<td>1 kHz – 100 kHz</td>
</tr>
<tr>
<td>E. Environmental</td>
<td>Quiet cruise: 171 – 3 log f(Hz)</td>
<td>10 Hz – 1 000 Hz</td>
</tr>
<tr>
<td>E. Environmental</td>
<td>Quiet cruise: 162 – 12 log f(kHz)</td>
<td>1 kHz – 100 kHz</td>
</tr>
<tr>
<td>E. Environmental</td>
<td>Transit: 183 – 5 log f(Hz)</td>
<td>10 Hz – 1 000 Hz</td>
</tr>
<tr>
<td>E. Environmental</td>
<td>Transit: 168 – 12 log f(kHz)</td>
<td>1 kHz – 100 kHz</td>
</tr>
</tbody>
</table>
3.1.2.3 The operating conditions shall be monitored during the measurements and the information specified in Table 1 shall as a minimum be recorded as accurately as practicable during the measurements.

3.1.2.4 The vessel shall be fully outfitted and carry a load within the normal load range for the operation in question. For vessels with larger variation than 25% in relevant displacements, measurements at two loading conditions close to the heavy and light displacement conditions may be decided by the Society in each particular case.

3.1.2.5 All equipment and systems normally in use, except hydro-acoustic equipment shall be running at their normal rated capacity or in the normal mode for the operation in question. Hydro-acoustic equipment shall be turned off during the measurements except if these systems are necessary for safe navigation of the vessel. If hydro-acoustic equipment shall be used for safety reasons, the type of equipment and frequency range of the signals shall be stated in the record of measuring conditions.

3.1.3 Acoustic (A) test conditions

3.1.3.1 The vessel shall be tested for a standard set of operating conditions which represent typical or expected operating conditions for the vessel.

3.1.3.2 Vessels which document that use of thrusters is irrelevant during acoustical operations can be allowed to conduct tests at the light survey condition only.

3.1.3.3 Vessels designed to use thrusters to conduct a survey shall be tested at the two sets of operating conditions specified further below.

Guidance note:
Light survey, represents a condition where the vessel is able to perform a survey using the main propulsion propeller(s) only. The thruster condition simulates the noise which will be generated if additional thrusters are used to maintain a course during a survey.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.1.3.4 An operational speed profile for typical hydro-acoustic operations for the vessel shall be submitted to the Society prior to the tests. The speed profile shall contain the maximum speed allowed when using the main hydro-acoustic equipment as well as expected operational speed(s) for the majority of the operations. The profile shall also indicate if side thrusters are expected to be used. Based on the received information, the Society will determine speed(s) at which the vessel shall be tested.

3.1.3.5 When relevant speed(s) for testing has been established, measurements shall be performed with the propulsion system in a normal configuration for the relevant speed(s).

3.1.3.6 When a thruster noise test is required, see [3.1.3.3], measurements shall be carried out with the thruster(s) operating at 40% of the rated load for the thruster(s).

3.1.4 Seismic (S) test conditions

3.1.4.1 Measurements shall be carried out towing the ordinary seismic equipment or simulated equivalent towing load. The equivalent towing load procedure shall be forwarded to the Society for approval prior to testing.

Guidance note:
Equivalent load may be established by calculations or from measured experience data from other vessels with similar seismic gear. The towing load should be established for the normal seismic towing speed for the vessel, or at 5 knots, or through a bollard pull method. The measured noise levels during bollard pull will be corrected using the Society's "Tip vortex method". No cavitating vortices should occur between the propeller and the hull during bollard pull.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
3.1.5 Fishery (F) test conditions

3.1.5.1 Vessels which can document that they will perform heavy towing/trawling only will be allowed to test at that condition only.

3.1.5.2 An operational speed profile typical for the vessel when operating hydro-acoustic search equipment shall be submitted to the Society prior to the tests. The speed profile shall contain the maximum speed allowed when using the main hydro-acoustic equipment as well as expected operational speed(s) for the majority of the operations. Based on the received information, the Society will determine speed(s) at which the vessel shall be tested.

3.1.5.3 For the trawling condition, the vessel shall tow its usual trawl or an alternative object yielding equivalent towing force at a distance of at least 150 m from the vessel at 4 knots or at the highest allowable speed for the trawl if this is less than 4 knots. The trawl or alternative object shall not touch the bottom.

3.1.5.4 If an alternative object will be towed, calculated or measured towing force for the standard trawl that the vessel will be equipped with as well as calculated or measured towing force for the alternative object shall be submitted to the Society for approval.

3.1.6 Research (R) test conditions

3.1.6.1 Research vessels > 50 m in overall length shall sail at 11 knots without towing any object and without the use of side thrusters.

3.1.6.2 Research vessels ≤ 50 m overall length shall sail at 8 knots without towing any object and without the use of side thrusters.

3.1.6.3 Only equipment and machinery necessary to achieve the stated free running speed and to maintain normal electric load shall be used during the testing.

3.1.6.4 Vessels equipped with drop keel(s) shall sail with one drop keel fully extended.

3.1.7 Environmental (E) test conditions

3.1.7.1 Vessels shall be tested at two different conditions: transit and quiet cruise.

3.1.7.2 The transit condition shall correspond to the normal seagoing condition, or 80% of maximum continuous power available at the propeller shaft(s).

3.1.7.3 The quiet cruise condition shall be performed at a speed of 11 knots if the overall vessel length > 50 m. For vessels ≤ 50 m, the test shall be performed for a speed of 8 knots.

3.1.7.4 All other machinery shall be run at normal operating conditions during the tests.

3.2 Reporting

3.2.1 General

3.2.1.1 The measured radiated noise levels shall be reported in 1/3 octave bands. The reporting shall comply with the requirements in DNVGL-CG-0313 Sec.2.

3.2.1.2 The Society will assess the reported results, documented operating conditions and any other relevant information. If the results are found to be acceptable the relevant Silent class notation will be issued.
3.2.1.3 The Society may, based on an evaluation of all factors associated with the measurements, accept deviations from the requirements.
SECTION 7 EXHAUST CLEANING SYSTEMS FOR THE REDUCTION OF NO$_x$ OR SO$_x$ - ER

1 General

1.1 Introduction
The additional class notation ER, emission reduction, provides criteria for the safe and environmentally friendly arrangement and installation of machinery for NO$_x$ and SO$_x$ exhaust gas emission reduction.

1.2 Objective
The objective with the additional class notation ER, emission reduction, is to provide requirements for arrangement and installation of machinery with the purpose of reducing NO$_x$ and SO$_x$ exhaust gas emission to air.

1.3 Scope

1.3.1 General
The scope includes requirements for the design and arrangement of EGCS, SCR and EGR systems, including the following:
— piping systems conveying wash water and/or treatment fluids
— exhaust arrangements and components
— control, monitoring and safety systems and components
— manufacture, workmanship and testing.

1.3.2 For compliance with MARPOL regulations, installed systems for the reduction of SO$_x$ emissions are considered mandatory installations for ships operating within emission control areas as defined by MARPOL Annex VI, or using exhaust gas cleaning for compliance with world-wide requirements as defined by MARPOL Annex VI.

Guidance note:
Where the Society is authorised to issue the IAPP certificate under MARPOL Annex VI, the requirements of IMO Res. MEPC.259(68) are considered to fall within the scope of the Society and documents and manuals specified in IMO Res. MEPC.259(68) are subject to approval.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

1.3.3 If an SCR or EGR system for the reduction of NO$_x$ is necessary to comply with MARPOL Annex VI Regulation 13, the installed systems are considered mandatory installations.

Guidance note:
Where the Society is authorised to issue the IAPP certificate under MARPOL Annex VI, the requirements of MARPOL Annex VI Regulation 13 / NO$_x$ Technical Code and MEPC.291(71) are considered to fall within the scope of the society and documents and manuals specified in MARPOL Annex VI Regulation 13 / NO$_x$ Technical Code are subject to approval.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

1.3.4 For ships designed to comply with the rules for redundant propulsion or dynamic positioning, emission reduction units and associated systems shall be designed not to interfere with the principles of Ch.2 Sec.7, Ch.3 Sec.2 or Ch.3 Sec.1. For notations requiring fully separated engine rooms (e.g. DYNPOS(AUTRO), DPS(3), RP(3, x)), each side shall be provided with a separate cleaning unit and any common piping shall have isolation valves at the bulkhead on both sides.
Guidance note:
The emission reduction function need not be arranged for availability according to these principles.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

1.3.5 For ships designed to comply with the rules for navigation in ice, exhaust gas cleaning seawater inlets and outlets for qualifiers EGR, EGCS open, EGCS hybrid and EGCS closed, shall be designed in accordance with the principles of the relevant section of Ch.6.

Guidance note:
Position, size, and shape of the scrubber ice sea chest, if applicable, may be calculated as for the main cooling water system ice sea chest. The grid dimensioning shall be adjusted for the added inlet pipe cross sectional area. Heating or hot water flushing arrangements for a dedicated scrubber ice sea chest should be specially considered as return of scrubber discharge water is generally not allowed according to these rules.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

1.4 Application
These requirements shall be applied to all vessels with NO\textsubscript{x} and/or SO\textsubscript{x} emission reduction systems.

Guidance note:
Novel designs or design principles not previously known to the Society are subject to special consideration based on the principles outlined in this section.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

1.5 Class notations

1.5.1 Ships complying with the requirements given in this section will be assigned the additional class notation ER with qualifier(s) as specified in Table 1.

**Table 1 Additional class notation - ER**

<table>
<thead>
<tr>
<th>Class notation</th>
<th>Qualifier</th>
<th>Purpose</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>ER</td>
<td>None</td>
<td>Installations for reduction of NO\textsubscript{x} or SO\textsubscript{x} emissions by novel means.</td>
<td>Applicable for emission reduction system for NO\textsubscript{x} and/or SO\textsubscript{x} by novel means which does not fall under any of the defined additional qualifiers. Such systems shall generally comply with the principles of these rules.</td>
</tr>
</tbody>
</table>

Additional qualifiers for NO\textsubscript{x} reduction systems

<table>
<thead>
<tr>
<th></th>
<th>Purpose</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC\textsubscript{R}</td>
<td>Installations for the reduction of NO\textsubscript{x} emissions by selective catalytic reduction systems</td>
<td>Applicable for all vessels where SCR systems are installed in one or more exhaust lines</td>
</tr>
<tr>
<td>E\textsubscript{GR}</td>
<td>Installations for the reduction of NO\textsubscript{x} emissions by recirculation of exhaust gas</td>
<td>Applicable for all vessels where EGR systems are installed in one or more exhaust lines</td>
</tr>
</tbody>
</table>
# Environmental protection and pollution control

## Class notation and Qualifier

<table>
<thead>
<tr>
<th>Class notation</th>
<th>Qualifier</th>
<th>Purpose</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier III</td>
<td></td>
<td>Installations for the reduction of NO(_x) emissions certified in compliance with the NO(_x) emission requirements of Tier III according to MARPOL Annex VI, regulation 13</td>
<td></td>
</tr>
</tbody>
</table>

### Additional qualifiers for SO\(_x\) reduction systems

<table>
<thead>
<tr>
<th>Qualifier</th>
<th>Purpose</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGCS open</td>
<td>Installations for removal of SO(_x) by use of seawater spray without means for recirculation (open loop scrubber system)</td>
<td>Applicable for all vessels where open loop scrubber systems are installed</td>
</tr>
<tr>
<td>EGCS closed</td>
<td>Installations for removal of SO(_x) by use of water spray in a closed circulation system (closed loop system)</td>
<td>Applicable for all vessels where closed loop scrubber systems are installed</td>
</tr>
<tr>
<td>EGCS hybrid</td>
<td>Installations for removal of SO(_x) by use of sea- or freshwater spray in open or closed circulation (open and closed loop system)</td>
<td>Applicable for all vessels where any configuration of hybrid scrubber systems are installed</td>
</tr>
<tr>
<td>EGCS dry</td>
<td>Installations for removal of SO(_x) by use of a dry medium through which the exhaust stream is passed</td>
<td>Applicable for all vessels where dry scrubber systems are installed</td>
</tr>
</tbody>
</table>

### Optional additional qualifiers

| Qualifier       | Purpose                                                                 | |
|-----------------|-------------------------------------------------------------------------| |
| Enhanced        | Installations with enhanced availability                              | Additional qualifier defining emission reduction systems as a system supporting the main functions of the vessel according to Pt.4 Ch.1 |
| Zero discharge (x) | Installations for removal of SO\(_x\) with holding tank capacity for (x) days | Additional qualifier for closed and hybrid exaust gas cleaning (EGC) systems with holding tank designed for 100% EGC system load for (x) days |
### 1.6 Definitions

#### 1.6.1 Terms and abbreviations

#### Table 2 Terms and abbreviations

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO$_x$</td>
<td>sulfur oxides</td>
</tr>
<tr>
<td>NO$_x$</td>
<td>nitrogen oxides</td>
</tr>
<tr>
<td>Emission reduction system</td>
<td>system for reduction of emissions to air, either by removal of harmful exhaust components, treatment of the exhaust gas or combustion additives. e.g. SCR, EGR or EGCS (scrubbers)</td>
</tr>
<tr>
<td>SCR</td>
<td>selective catalytic reduction (for reduction of NO$_x$ emissions)</td>
</tr>
<tr>
<td>EGR</td>
<td>exhaust gas recirculation (for reduction of NO$_x$ emissions)</td>
</tr>
<tr>
<td>EGC(S)</td>
<td>Exhaust gas cleaning (system) (for reduction of SO$_x$ emissions), also known as scrubbers</td>
</tr>
<tr>
<td>open loop scrubber system</td>
<td>scrubber system which remove SO$_x$ from the exhaust by spraying seawater into the exhaust stream and discharging the used water overboard. Such systems may use additional treatment fluids for performance enhancements or discharge water pH control.</td>
</tr>
<tr>
<td>closed loop scrubber system</td>
<td>scrubber systems which remove SO$_x$ from the exhaust by spraying treated freshwater or seawater into the exhaust stream and subsequently treating and cooling the used wash-water prior to re-use in a semi-closed system. Such systems require several treatment fluids and systems for cleaning of the wash water, and generates relatively small discharge volumes compared to open loop systems.</td>
</tr>
<tr>
<td>hybrid scrubber system</td>
<td>various types of scrubber systems based on a combination of an open and a closed loop</td>
</tr>
<tr>
<td>dry scrubber system</td>
<td>various types of scrubber systems which remove SO$_x$ from the exhaust gas by the absorption of SO$_x$ into a dry chemical</td>
</tr>
<tr>
<td>catalyst layer</td>
<td>internal structure in SCR units comprised of a structure supporting blocks of permeable (e.g honeycomb) catalyst blocks through which the exhaust passes and reacts with the vaporized treatment fluid at the catalyst surface</td>
</tr>
<tr>
<td>packing bed</td>
<td>internal grid structure in EGCS units for increasing scrubber efficiency</td>
</tr>
<tr>
<td>demister</td>
<td>internal grid structure in the outlet of EGCS units for reduction of scrubbing water mist at exhaust outlet</td>
</tr>
<tr>
<td>I-type</td>
<td>EGCS unit with bottom exhaust inlet and top exhaust outlet, yielding an I-shaped exhaust stream</td>
</tr>
<tr>
<td>U-type</td>
<td>EGCS unit with the exhaust inlet and outlet at or near the top, yielding a U-shaped exhaust stream</td>
</tr>
<tr>
<td>multi-inlet</td>
<td>Emission reduction unit where multiple exhaust sources are connected</td>
</tr>
<tr>
<td>single stream</td>
<td>Emission reduction unit where a single exhaust source is connected</td>
</tr>
</tbody>
</table>
1.7 Documentation requirements

1.7.1 Documentation shall be submitted as required by Table 3 and Table 4 according to the selected qualifier(s). Table 4 is applicable only when the Society is authorised to issue IAPP certificates.

1.7.2 For emission reduction systems with Enhanced qualifier, additional documentation may be required for the system as defined in Pt.4 Ch.8.

1.7.3 For emission reduction systems type approved by the Society, the scope of documentation to submit is stated in the approval certificate.

1.7.4 For general requirements to documentation, including definition of the info codes, see DNVGL-CG-0550 Sec.6.

1.7.5 For a full definition of the documentation types, see DNVGL-CG-0550 Sec.5.

Table 3 Documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCR</td>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>Including exhaust gas treatment fluid systems</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>Arrangement and details of by-pass valve/dampers</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>S020 – Pressure drop Analysis</td>
<td>Back pressure calculation as per [4.1.4] (including allowable backpressure for connected machinery)</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>I200 – Control and monitoring system documentation</td>
<td>Covering emission reduction unit control and safety systems</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z161 – Operation manual</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td>EGR</td>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>Treatment fluid systems</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>Water supply to exhaust gas cleaning units</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>Waste and discharge systems from exhaust gas cleaning units</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>Arrangement and details of by-pass valve/dampers</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>I200 – Control and monitoring system documentation</td>
<td>Covering emission reduction unit control and safety systems</td>
<td>AP</td>
</tr>
<tr>
<td>Object</td>
<td>Documentation type</td>
<td>Additional description</td>
<td>Info</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------</td>
<td>------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Z161 – Operation manual</td>
<td></td>
<td>Including tests addressing failure impact on main functions as per [10.3.1]</td>
<td>FI</td>
</tr>
<tr>
<td>Z253 – Test procedure for quay and sea trial</td>
<td></td>
<td></td>
<td>AP</td>
</tr>
</tbody>
</table>

**EGCS open**

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>Systems for prevention of component overheating</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>Arrangement and details of by-pass valve/dampers</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>S020 – Pressure drop analysis</td>
<td>Back pressure calculation as per [4.1.4](including allowable backpressure for connected machinery)</td>
<td>FI</td>
<td></td>
</tr>
<tr>
<td>I200 – Control and monitoring system documentation</td>
<td>Covering both cleaning unit control and safety systems</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>Z161 – Operation manual</td>
<td>Alternatively exhaust gas cleaning system technical manual (ETM)</td>
<td>FI</td>
<td></td>
</tr>
<tr>
<td>E170 - Electrical schematic drawing</td>
<td>Emergency stop of pumps</td>
<td>FI</td>
<td></td>
</tr>
<tr>
<td>Z253 – Test procedure for quay and sea trial</td>
<td>Including tests addressing failure impact on main functions as per [10.3.1]</td>
<td>AP</td>
<td></td>
</tr>
</tbody>
</table>

**EGCS closed**

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>Treatment fluid systems</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>Water supply to exhaust gas cleaning units</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>Waste and discharge systems from exhaust gas cleaning units</td>
<td>AP</td>
<td></td>
</tr>
</tbody>
</table>

**EGCS hybrid**

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>Absorbent storage and supply to exhaust gas cleaning units</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>S011 - Piping and instrumentation diagram (P &amp; ID)</td>
<td>System for handling spent absorbent</td>
<td>AP</td>
<td></td>
</tr>
</tbody>
</table>

**EGCS dry**

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z070 - Failure mode description</td>
<td>Failure mode report for the EGCS control and safety system</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>G130 - Cause and effect diagram</td>
<td></td>
<td>AP</td>
<td></td>
</tr>
</tbody>
</table>

**Enhanced**

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>S030 - Capacity analysis</td>
<td>Discharge water holding tank calculation</td>
<td>AP</td>
<td></td>
</tr>
</tbody>
</table>

AP = For approval; FI = For information
Table 4 Additional required documentation for ships provided with exhaust gas cleaning systems for SO\textsubscript{x} where the Society is authorized to issue the IAPP certificates

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaust gas SO\textsubscript{x} cleaning systems</td>
<td>Z161 – Operation manual</td>
<td>SO\textsubscript{x} emission compliance plan (SECP)</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z161 – Operation manual</td>
<td>Exhaust gas cleaning system technical manual (ETM). Scheme A or B as applicable</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z161 – Operation manual</td>
<td>Onboard monitoring manual (OMM)</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z270 – Record</td>
<td>EGC record book or electronic logging system</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z253 - Test procedure for quay and sea trial</td>
<td>According to the requirements of MEPC 259(68)</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>I200 – Control and monitoring system documentation</td>
<td>Covering environmental measurements, analysers and recording devices</td>
<td>AP</td>
</tr>
</tbody>
</table>

AP = for approval, FI = for information

1.8 Certification requirements

1.8.1 Certification required for emission reduction system components is summarised in Table 5.

Table 5 Certification requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Additional description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission reduction systems for NO\textsubscript{X}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment fluid pumps</td>
<td>PC</td>
<td>Manufacturer</td>
<td></td>
</tr>
<tr>
<td>Control and monitoring systems</td>
<td>PC</td>
<td>Society</td>
<td>See Pt.4 Ch.9</td>
</tr>
<tr>
<td>Exhaust gas cleaning systems for SO\textsubscript{x}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water pumps</td>
<td>PC</td>
<td>Manufacturer</td>
<td></td>
</tr>
<tr>
<td>Treatment fluid pumps</td>
<td>PC</td>
<td>Manufacturer</td>
<td></td>
</tr>
<tr>
<td>Control and monitoring systems</td>
<td>PC</td>
<td>Society</td>
<td>See Pt.4 Ch.9</td>
</tr>
<tr>
<td>I-type EGCS unit with bottom inlet</td>
<td>MC</td>
<td>Manufacturer</td>
<td>See [3.1.7]</td>
</tr>
<tr>
<td>Plastic piping</td>
<td>TA</td>
<td>Society</td>
<td>See [2.4.1]</td>
</tr>
</tbody>
</table>

For certification requirements for other equipment and components see Pt.4 Ch.6 Sec.1. Valves in the exhaust line for bypass or blocking of exhaust to a multi-inlet unit may be required type approved (TA) by the Society for use in exhaust systems depending on the sealing air arrangement according to [4.2] and [4.3].

1.8.2 For systems with qualifier Enhanced, certification required for emission reduction system components are summarised in Table 6.
### Table 6 Certification requirements for qualifier Enhanced

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Additional description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission reduction systems for NO$_x$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment fluid pumps</td>
<td>PC</td>
<td>Society</td>
<td></td>
</tr>
<tr>
<td>Control and monitoring systems</td>
<td>PC</td>
<td>Society</td>
<td>See Pt.4 Ch.9</td>
</tr>
<tr>
<td>Exhaust gas cleaning systems for SO$_x$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water pumps</td>
<td>PC</td>
<td>Society</td>
<td></td>
</tr>
<tr>
<td>Treatment fluid pumps</td>
<td>PC</td>
<td>Society</td>
<td>See Pt.4 Ch.9</td>
</tr>
<tr>
<td>Control and monitoring systems</td>
<td>PC</td>
<td>Society</td>
<td>See Pt.4 Ch.9</td>
</tr>
<tr>
<td>EGC unit</td>
<td>MC Manufacturer</td>
<td></td>
<td>See [8.1.3.4]</td>
</tr>
<tr>
<td>Plastic piping</td>
<td>TA</td>
<td>Society</td>
<td>See [2.4.1]</td>
</tr>
</tbody>
</table>

Associated electric equipment (motors, switchgear, control gear and frequency converters) serving an item that is required to be delivered with a product certificate issued by the Society is regarded as important equipment, and shall be certified as required by Pt.4 Ch.8 Sec.1 [2.3.2].

Valves in the exhaust line for bypass or blocking of exhaust to a multi-inlet unit may be required type approved (TA) by the Society for use in exhaust systems depending on the sealing air arrangement according to [4.2] and [4.3].

1.8.3 For general certification requirements, see DNVGL-CG-0550 Sec.4.

1.8.4 For a definition of the certification types, see DNVGL-CG-0550 Sec.3.

### 2 Materials

#### 2.1 General

2.1.1 Metallic materials shall be in accordance with the requirements of Pt.2.

2.1.2 Materials other than those covered by Pt.2 may be accepted subject to approval in each separate case.

2.1.3 The materials used for piping systems and components shall be in accordance with the requirements of Pt.4 Ch.6 as relevant for the selected system and media, and as specified in this section.

#### 2.2 Components

2.2.1 Emission reduction system components which are considered part of the exhaust system shall be made of materials with a melting point above 925°C, unless arranged with bypass and systems preventing overheating are provided and arranged with redundancy. Such designs are subject to a separate case by case approval and may be subject to additional requirements to ensure that material temperature tolerances are not exceeded at any time in operation and during/after shut down, and that corrective measures are implemented.
2.2.2 EGCS units constructed from plastic materials shall be certified according to the requirements of Pt.4 Ch.6 Sec.2 as a non-essential seawater system. The scope of testing and evaluation of placement of the scrubber is subject to case by case approval.

2.2.3 EGCS units and exhaust piping exposed to the cleaning water or treated exhaust shall be suitable for the corrosive properties of the two media.

2.3 SCR piping and tanks

2.3.1 If located in a high fire risk space, urea tanks for SCR systems shall be made of stainless steel or equivalent material with a melting point above 925°C. Materials shall be suitable for storage and transportation of the treatment fluid or mixtures thereof (see IACS UR M77).

Guidance note:
Steel tanks and vent pipes with an efficient corrosion protection system, either free standing tanks or structural tanks, are also considered suitable for this use. Vent heads are not required to be made of stainless steel.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3.2 SCR urea transfer and dosing systems shall be classed as per other media with regard to Pt.4 Ch.6 Sec.1 [2.1.5] and shall comply with the requirements of Pt.4 Ch.6 accordingly. The use of plastic piping is subject to the requirements of Pt.4 Ch.6 Sec.2 [1.7].

2.4 EGCS piping and tanks

2.4.1 Plastic wash water supply, circulation and discharge piping for EGCS systems shall be type approved according to the design requirements, test standards and test conditions specified in DNVGL-CP-0070 or DNVGL-CP-0072, and shall comply with Pt.4 Ch.6 Sec.10 [4] and Pt.4 Ch.6 Sec.10 [5].

Guidance note:
See also Pt.4 Ch.6 Sec.2 [1.7] for fire endurance requirements. The special waivers according to Pt.4 Ch.6 Sec.2 [1.7.6] of those rules do not apply for piping installed for ER systems.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3 Design principles

3.1 Component and system design

3.1.1 Emission reduction systems are generally not considered an essential or important system according to main class except where specified in these rules. Availability of scrubber systems is thus generally not considered in scope of approval. However the installation shall comply with the rules for main class where the installation may affect other main functions as defined in Pt.1 Ch.1 Sec.1 [2.1.2].

Guidance note:
Although emission reduction units are subject to assessment of risk of failure (e.g. clogging) they should not be considered an active component provided arranged in accordance with these rules.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.1.2 Interfaces to other ship systems shall be arranged to prevent the back-flow of fluids or exhaust gas into such systems. Steam or compressed air supply valves for soot cleaning arrangements are not covered by this requirement. Treatment fluid tank heating or washing arrangements are subject to special considerations.
3.1.3 Where multiple emission reduction units are served by a common wash water or treatment fluid supply system, a leaking isolation valve shall not result in ingress of fluid into idle units.

Guidance note:
This may be achieved by arranging two automatic isolation valves in series or maintaining availability of sufficient continuous drainage for the idle unit.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.1.4 Where the design of the emission reduction system is considered to require additional means for cleaning (e.g. due to soot build up), such arrangements are subject to approval. The system shall be automatically operated and arranged with minimum redundancy type 3 as defined in Pt.4 Ch.1 Sec.1 Table 1.

Guidance note:
See also Pt.4 Ch.1 Sec.5 [1.1.5].

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.1.5 Automatic systems for cleaning due to soot build up shall be provided for SCR units where engines may be operated on heavy fuel oil and for demisters and packing beds on EGCS units without bypass. The system shall be arranged with redundancy as defined in [3.1.4] and shall remain in operation for units without bypass when the emission reduction system is not in use (dry mode).

3.1.6 Valves or dampers arranged for remote or automatic operation shall be provided with position indication (both local and remote).

3.1.7 EGCS units designed with bottom exhaust inlets, e.g I-type scrubbers, or otherwise designed such that a structural failure in the scrubber unit may cause water ingress into the exhaust line below, shall be provided with material certificate for the scrubber unit (MC- issued by manufacturer) and the welding of joints shall be carried out by qualified welders using approved welding procedure specifications and type approved welding consumables, see Pt.2 Ch.4.

4 Exhaust systems

4.1 General

4.1.1 Exhaust pipes from multiple engine installations (i.e. main engines for propulsion, auxiliary engines for power generation, boilers etc.) shall not be connected, but shall have separate outlets, unless arranged with bypass according to these rules or other precautions are taken to prevent the loss of main function in the event of failure and to prevent the return of exhaust gases to a stopped engine installation.

4.1.2 Bypass shall be arranged where failure may lead to loss of power generation or propulsion as defined by Pt.4 Ch.1 Sec.3 [2.3]. This may be dispensed with if unrestricted flow is ensured and no risk of failure leading to shut down of the connected machinery is demonstrated. Acceptable means for ensuring no risk of failure leading to shutdown shall in such case include:

— all components that may come in contact with exhaust shall be made of materials with melting point above 925°C. Components not in direct contact should be suitable for the placement with respect to local temperature increase in dry mode
— soot cleaning shall be arranged for SCR catalyst blocks, EGCS packing beds (if applicable) and EGCS demister per [3.1.3] regardless of fuel type
— elevated minimum operational temperature for prevention of soot build up, alternatively active or passive thermal regeneration in case of soot build up, shall be provided for SCR units. The functionality shall be confirmed by SCR- and engine manufacturer.
— propulsion systems with HFO fuelled main engine(s) shall be able to manoeuvre on MGO or MDO in case of increased build up of residues on catalysts or scrubber packing beds (e.g. due to poor fuel quality). The ECA(SOx-A) class notation may serve as basis for evaluation of the fuel system capabilities.

4.1.3 Exhaust outlets from engine installations used for emergency operations (e.g. emergency fire pump engines, emergency generator engines) shall have independent exhaust outlets.

**Guidance note:**
Engine installations solely used for emergency operations are not required to comply with MARPOL Annex VI Reg.13.

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4.1.4 It shall be documented that the pressure drop in the emission reduction system does not exceed the maximum allowable according to the engine and machinery component manufacturers. The pressure drop assessment shall be performed from the exhaust outlet of the engine installations to the exhaust outlet to open air. It shall include pressure drop from pipes and fittings as well as other components that contribute to pressure drop (e.g. silencers, exhaust gas boilers, SO\textsubscript{x} or NO\textsubscript{x} reduction units). For emission reduction where multiple exhaust sources are coupled to the same emission reduction unit, the total pressure drop for all connected units shall be calculated.

The pressure drop shall take into account the exhaust gas flow corresponding to maximum specified operating load of the engine installations.

4.1.5 EGCS units shall be arranged with a drainage system capable of draining the maximum water supply to the unit, including fire extinguishing or soot cleaning if applicable. The unit shall be provided with independent water level detectors for alarm and cleaning unit system shutdown.

4.1.6 Emission reduction systems shall be arranged so as to prevent ingress of treatment fluids or water into the engine installations served in case of dosing system failure or treatment unit structural failure. Drain pots should be provided to this effect, with a drainage system that is capable of draining when the unit is in operation. The drainage for non-urea based SCR systems shall be led to a tank of suitable size.

**Guidance note:**
SCR systems may be accepted without drain pot arranged according to this rule if the injection control system is type approved for this purpose.

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4.1.7 Where exhaust gas fans for the prevention of excessive back-pressure are needed, the emission reduction unit causing the excessive pressure drop shall be arranged with bypass. Fans shall be arranged with redundancy if deemed necessary for safety of the system.

**Guidance note:**
Fans may be deemed necessary for safety of the system e.g. in case the intermittent back-pressure during changeover to bypass for fan failure may cause hazardous situations or damage to machinery.

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4.1.8 For SCR systems where the treatment fluid has significant corrosive properties at elevated temperatures, the exhaust piping and associated valves and fittings shall be made of stainless steel from the point where the treatment fluid is injected into the exhaust gas and until it is fully vaporized. The requirement for stainless steel may be waived if the exhaust line after the injector is not arranged with bends for the distance specified by the manufacturer.

**Guidance note:**
Applies to urea and similar types of treatment fluids.

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4.1.9 Exhaust dampers (or valves) required to be functional at any time to maintain passage of exhaust (including in case of emission reduction system failure and shutdown) and dampers (or valves) installed
to prevent back-flow to idle units, shall be fitted with a permanently connected soot cleaning arrangement for contact surfaces, or equivalent arrangements maintaining the valve operability. Soot cleaning may be arranged by compressed air, steam or water. Equivalent arrangements (e.g. self-cleaning valves) are subject to case by case approval.

Guidance note:
Double-bladed (also known as split blade) dampers with sealing air, flush inner walls in the damper housing and no contact in closed position between the damper blades and the outer wall (i.e. designed not to be fully sealing), may be considered an equivalent arrangement as these are considered not requiring additional soot cleaning. Dampers with mechanical scraping rings of proven design may also be acceptable, however inspection hatches for manual cleaning by means of flexible lances supplied from permanently fitted connections to steam, air or water systems may be required for unproven designs.

---end-of-guidance-note---

4.2 Bypass arrangements

4.2.1 Bypass valves shall be operated from the control station for the emission reduction system. The valves shall fail to safe mode upon loss of power supply or upon a failure in the pneumatic supply to the actuator(s).

4.2.2 It shall not be possible to close the bypass damper unless the corresponding inlet damper is confirmed open. It shall also not be possible to close the inlet damper unless the corresponding bypass damper is confirmed open. A single failure in the system(s) controlling the dampers shall not prevent free exhaust flow. The above damper-logic shall be implemented in the relevant control system(s).

Guidance note:
How the requirement concerning effect of single failure is complied with will depend on the actual damper arrangement, e.g:
— Mechanical linkage between the bypass- and inlet damper with one common actuator. Actuator to be on the bypass damper to ensure that this can be actuated. Control system SW to include logic to open the bypass in case of broken link.
— Other independent mechanical interlock (e.g pneumatic) complying with the above intention.
— PS/PT installed upstream bypass- and inlet damper, wired to the independent safety system and arranged so that the bypass will open in case of high back pressure.
— Other independent electrical interlock, arranged so that a damper close-command not will reach the solenoid unless the "other" damper is confirmed open.

---end-of-guidance-note---

4.2.3 The bypass arrangement shall automatically open to bypass mode in case of an emission reduction system shutdown or an increase of back-pressure that may affect the engine served.

4.2.4 Inlet damper arrangements shall prevent exhaust back-flow into systems/idle machinery. As the bypass shall be open when the inlet is closed according to [4.2.2], any exhaust backflow through a leaking inlet damper is expected to flow to bypass line and not reach the idle machinery. Acceptable means for prevention of exhaust backflow for such arrangements includes, but are not limited to:
— single valve, type approved by the Society for use in exhaust systems
— single (non-sealing) damper with non-redundant exhaust fan maintaining under-pressure at the common manifold side of the damper, with alarm for loss of under-pressure
— double-bladed (also known as split blade, non-sealing) dampers with non-redundant sealing air supply and alarm for loss of sealing air pressure.

4.2.5 Bypass systems shall be designed for the maximum exhaust flow in the system.
4.3 Blocking arrangements

4.3.1 Blocking dampers or valves without bypass in common emission reduction systems arranged according to [4.1.2] shall be remotely operated. The valves shall automatically close when the connected machinery is stopped, automatically open prior to start of connected machinery, and fail-to-open position upon loss of power supply or upon a failure in the pneumatic supply to the actuator.

4.3.2 The machinery shall be protected from starting against a closed exhaust line for any single failure in the control system.

Guidance note:
Exhaust blocking arrangements should, if possible, be operated and monitored by the engine control and safety system. Otherwise the dampers or valves should be operated and monitored by the emission reduction system control and safety system.

4.3.3 Maximum allowable backpressure shall not be exceeded during starting of connected machinery, including blackout and standby start.

4.3.4 The blocking valves shall automatically open in case of manual emergency stop of scrubber system.

4.3.5 The blocking arrangement shall be fitted with means to seal the damper in closed position during machinery maintenance.

4.3.6 Blocking arrangements without individual bypass lines shall prevent exhaust back-flow into systems/idle machinery in case of exhaust gas leakage. Acceptable means for prevention of exhaust leakage includes, but are not limited to:

— single valve, type approved by the Society for use in exhaust systems, with sealing air supply and alarm for loss of sealing air pressure
— single damper with redundant exhaust fans (according to [4.1.7]) maintaining a relative under-pressure at EGCS side of valve with alarm for loss of pressure differential
— double-bladed (also known as split blade, non-sealing) dampers with redundant sealing air supply and alarm for loss of sealing air pressure.

5 Selective catalytic reduction systems

5.1 General

5.1.1 The requirements of this subsection apply generally for emission reduction systems using selective catalytic reduction, SCR, for the reduction of NOx emissions.

Guidance note:
For piping systems type approved by the Society according to DNVGL-CP-0353, the installation shall be reviewed according to the application/limitation field in the certificate. SCR systems arranged before the engine turbo charger (HP - high pressure system) are normally type approved as an engine sub-system.

5.2 Urea solution based treatment fluid systems

5.2.1 Treatment fluid supply and tank vent system shall be separated from other piping systems onboard.
5.2.2 Air and sounding pipes shall be led to open air. Air pipes shall be arranged to prevent entrance of water to the urea tanks and shall terminate in a safe location with respect to the possible urea fumes in case of a fire near the storage tank(s). Short sounding pipes may be accepted if arranged as for fuel tanks according to Pt.4 Ch.6 Sec.4 [11]. Urea tank air pipes should not terminate in a location where ammonia fumes from high temperature decomposition of the urea may render muster stations inaccessible.

5.2.3 Tanks and piping systems shall be located in a well-ventilated space and piping shall not be led through accommodation, service spaces or control stations. If located in a separate space, the area shall be served by a ventilation system separate from accommodation, service spaces and control stations, providing not less than 6 air changes per hour (see IACS UR M77).

5.2.4 Drip trays shall be fitted under those parts of the urea systems which are often opened up for cleaning such as filters, pumps, etc. All urea tanks shall be equipped with drip trays of sufficient capacity and height for collecting any leakage of urea that may occur from valves, fittings etc (see IACS UR M77). Tank vent heads are not required to be fitted with spill trays.

5.2.5 Storage tanks shall be maintained within the correct temperature range applicable to the particular concentration of the solution. Where urea tanks are situated near to boilers or other hot surfaces, the tanks shall be well insulated (see IACS UR M77).

Guidance note:
Depending on the operational area of the ship, this may necessitate the fitting of heating and/or cooling systems. The physical conditions recommended by applicable recognized standards (such as ISO 18611-3) should be taken into account to avoid any impairment of the urea solution during storage.

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5.2.6 Urea tanks shall not be located adjacent to, and urea piping shall not pass through, tanks for feed water, drinking water or fuel oil (see IACS UR M77).

Guidance note:
As the purpose is to prevent ingress of fuel into urea tanks and urea into the feed water or drinking water tanks, arrangements complying with this principle may be accepted.

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5.2.7 Every urea inlet or outlet pipe, that would allow urea to escape from the tank if damaged, shall be provided with a shut-off valve directly on the tank. Short distance pieces of rigid construction are acceptable (see IACS UR M77).

5.2.8 The following protective equipment shall be provided in the vicinity of, but in a safe distance from, the bunker station and treatment pumps: appropriate chemical resistant protective gloves, respiratory protection if mist or dust may occur, tight fitting protective goggles or face shield, and fixed or portable eye wash equipment.

5.2.9 Treatment systems involving processes that may lead to generation of vapours that are flammable or hazardous to crew are subject to special considerations. See Sec.1 [3.4.2].

5.2.10 Systems and arrangements for pre-decomposition of urea prior to injection into the exhaust stream are subject to special considerations according to the requirements for non-urea based treatment fluid systems.

5.2.11 Where selective catalytic reduction (SCR) type emission reduction systems are applied, excessive slip shall be prevented.
5.3 Other treatment fluid systems

5.3.1 Treatment fluid supply systems shall be separate from other piping systems on board.

5.3.2 Treatment fluids considered to represent a hazard to personnel, pertain to class I piping systems regardless of design pressure (see IACS UR P2).

5.3.3 Treatment fluids with flashpoint below 60°C shall not be accepted. Anhydrous ammonia and aqueous ammonia shall not be used as a reductant in an SCR except where it can be demonstrated that it is not practicable to use a urea based reductant.

5.3.4 Tanks (including buffer tanks for water and treatment fluid mixes) and piping systems for treatment fluids that have corrosive properties or are considered to represent a hazard to personnel, shall be designed in accordance with the requirements to fuel oil systems in Pt.4 Ch.6 Sec.5 [4], and with the following additional requirements:

a) Materials in tanks and piping systems shall be suitable for storage and transportation of the treatment fluid or mixtures thereof.

b) Air and sounding pipes to tanks shall be led to open air and shall terminate in such a location that possible spray does not represent a hazard to personnel.

c) Tanks and piping systems shall be located in a well-ventilated space and shall not be led through accommodation, service spaces or control stations. If located in a separate space, ventilation capacities and leakage detection systems may be specially considered.

d) Piping systems shall have all welded connections, except in way of valves or connections to equipment.

e) Leakage sources shall be provided with spill trays leading to a closed tank. This also applies to bunker stations for treatment fluids. Leakage sources shall be screened so that possible spray does not endanger personnel.

f) Valves fitted below the top of tanks shall for all tank sizes be arranged for quick acting shut-off from a central position outside the space where the tanks are located, and at a safe distance from openings to the same space.

Guidance note:
Treatment fluids are subject to assessment of hazards and location of tanks and piping may be subject to special considerations. Emission reduction systems utilising flammable fluids are subject to special considerations also taking into account requirements in Pt.4 Ch.6 Sec.5.

Emission reduction systems utilising ammonia (R717) are subject to the safety requirements in Pt.4 Ch.6 Sec.6. See also [5.3.3].

5.3.5 If treatment fluids are considered representing a hazard to personnel, following protective measures shall be provided:

— Eye wash and showers shall be provided in the vicinity of the treatment fluid bunker manifold as well as in the vicinity of, but in a safe distance from, treatment fluid pumps. Showers and eye wash may drain to bilge or sanitary discharge systems.

— Three (3) sets of protective equipment, covering all skin so that no part of the body is unprotected (large aprons, special gloves with long sleeves, suitable footwear, coveralls of chemical resistant material, tight-fitting goggles or face shields or both). The equipment shall be resistant to the treatment fluid in question. The equipment shall be used by personnel during bunkering and in operations which may entail danger to personnel.
The protective equipment shall be provided in easily accessible lockers outside the accommodation.

5.3.6 Piping systems and tanks for residues/sludge generated by the emission reduction systems shall be separate from bilge water systems and the normal engine room bilge and sludge system, except for a common discharge piping to deck manifold.

5.3.7 Treatment systems involving processes that may lead to generation of vapours being flammable or hazardous to crew, are subject to special considerations, see Sec.1 [3.4.2].

5.3.8 Where selective catalytic reduction (SCR) type emission reduction systems are applied, excessive slip shall be prevented.

Guidance note:
The method for preventing excessive slip is subject to case by case approval. Monitoring of urea injection flow relative to engine load or other relevant load characteristics may be an acceptable solution.

6 Exhaust gas recirculation systems

6.1 General

6.1.1 The requirements of this subsection generally apply for emission reduction systems based on exhaust gas recirculation principles, (EGR), where a controlled proportion of the exhaust gas is recirculated to the inlet air for the reduction of NO\textsubscript{x} emissions.

Guidance note:
For systems type approved by the Society the installation shall be reviewed according to the application/limitation field in the certificate. An EGR system is typically arranged before the engine turbo charger (HP - high pressure system), and the system will normally be type approved as an engine sub-system.

6.1.2 For EGR systems on HFO fuelled machinery arranged with cleaning systems for removal of SO\textsubscript{x} from the return exhaust, the auxiliary wash water and treatment fluid systems shall be designed and tested according to the relevant EGCS qualifier.

6.1.3 Where the Society is authorised to issue the IAPP certificate under MARPOL Annex VI, overboard discharge of bleed off water from an EGR water treatment system shall comply with the requirements of MEPC.307(73).

Guidance note:
The operational requirements of the guideline are not considered subject for approval.

Guidance note:
Bleed off water from EGR systems on machinery using compliant fuel according to regulation 14 of MARPOL Annex VI shall in such case be monitored according to MEPC 107(49) if discharge overboard is possible.

Guidance note:
Bleed off water from EGR systems on machinery using non-compliant fuel according to regulation 14 of MARPOL Annex VI shall in such case be monitored according to the requirements of MEPC.259(68) pertaining to washwater and sludge handling if discharge overboard is possible. EGR bleed off water from HFO fueled machinery may be monitored by the same equipment as the EGC discharge, or be fitted with a separate monitoring system. Documents and manuals specified in MEPC.259(68) are subject to approval.
6.2 Waste and discharge systems

6.2.1 Piping systems and tanks for residues/sludge generated by the EGR water treatment system shall be separate from bilge systems and the normal engine room sludge system, except for a common discharge piping to deck manifold.

7 EGC systems

7.1 General

7.1.1 The requirements in this subsection are generally applicable for all EGCS qualifiers, and for EGR qualifier on installations for HFO fuelled machinery.

7.1.2 If an SO$_x$ emission reduction system using dry absorbent(s) is installed, the EGCS dry qualifier is applicable and the system shall comply with the principles of this subsection as applicable for the system design.

7.2 Sea water systems

7.2.1 Strums shall be fitted to all sea chest openings in the shell plating. The total area of the strum holes shall be at least twice the total flow area in the sea water inlet valves.

7.2.2 Regarding sea inlets, see Pt.4 Ch.6 Sec.3 [1.3]. Approved remote closing arrangements for sea inlets and discharges where plastic piping is used may be arranged by single acting valves which fail to closed position, unless Enhanced qualifier is selected.

7.2.3 Materials and coatings in tanks and piping systems shall be suitable for the corrosive properties of the cleaning water. Structural tanks shall not be used for untreated cleaning water.

7.2.4 Air and sounding pipes to tanks shall be led to open air and shall terminate in such a location that possible spray or fumes do not represent a hazard to personnel.

7.2.5 The seawater supply system shall be separate of other seawater piping systems on board. Connections to other seawater supply systems are acceptable provided means for prevention of backflow are arranged.

7.2.6 The EGCS seawater pumps and sea chest arrangements shall have sufficient capacity for supplying the system at maximum EGCS load and without interfering with any essential service on the ship.

7.2.7 Water discharge piping from the EGCS shall be separate from other seawater piping systems and shall be led overboard through a separate discharge outlet. Seawater from other systems used for diluting are acceptable provided means for prevention of backflow are arranged.

7.2.8 Discharge water piping, including valve(s), shall be protected against corrosion. Distance piece between overboard valve and shell plating shall be of substantial thickness, at least shell plate thickness, but not less than 15 mm.

**Guidance note:**
If coating is used for corrosion protection, special care should be taken during application of the coating in the flange area, and the coating should be abrasive resistant and suitable for the media and temperature. Coating should not be used where the pipe is fitted with internal structures, e.g. bluff bodies or similar structures installed for compliance with the dilution criteria of MEPC.259(68).

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Guidance note:
Traditional stainless steels, including type 316 or 316L, should not be considered suitable for use in seawater systems. However, certain stainless steels with higher contents of chromium, molybdenum and nitrogen have improved resistance to localised corrosion. These include high molybdenum austenitic steels and ferritic-austenitic (duplex) steels. Even these steels cannot be considered immune to attack under all situations. Avoidance of stagnant seawater conditions and removal of welding oxides are some of the important factors for successful use. As the overboard distance piece is normally not subject to stagnant seawater, these steels may be accepted.

---end---of---guidance---note---

7.2.9 Discharge water overboard outlets shall be arranged in such a way as to prevent the discharge water from being drawn into sea suctions for other pipe systems, e.g. systems for cooling water for machinery or freshwater generation.

Guidance note:
The discharge outlet should be located minimum 4 meters aft of any sea water inlet and well below the waterline for any loading condition.

---end---of---guidance---note---

7.2.10 If the EGCS discharge system is arranged with any openings or equipment below the freeboard deck which is regarded as an open end according to Pt.3 Ch.12 Sec.9, the discharge(s) shall be fitted with a non return valve in addition to the remote operated overboard valve.

Guidance note:
Water treatment and monitoring equipment is not considered inboard open ends in relation to this rule if the inlet and outlet pipes to the equipment is smaller than DN50. The scrubber unit should be fitted above the freeboard deck.

---end---of---guidance---note---

7.2.11 Drainage arrangements and a high-high bilge level detector shall be fitted in spaces containing the exhaust gas cleaning system to detect any major cleaning water leak, including, but not limited to, engine room, the engine room casing and any other space normally not fitted with bilge wells, through which the sea water supply is routed. The level detector shall shut down all water supply pumps and trigger automatic cleaning system shutdown. The drain lines may be led to a bilge well in the main bilge system.

Where the space shall be fitted with bilge well and level detection according to main class or other class notations, a separate scrubber bilge level detector should be fitted higher than the ship bilge detection level to avoid spurious shutdown of the system. Using the ship bilge detector may, however, be acceptable if Enhanced qualifier is not selected.

7.2.12 For EGC systems with I-type units, or similarly arranged with an internal geometry with an increased risk of wash water overflow through the exhaust inlet, the following additional requirements apply:

a) The level build up alarm sensors for cleaning unit and associated tanks shall, in addition to triggering alarm, also shut down water supply to the relevant scrubber unit.

b) The level build up sensors in the scrubber unit shall be placed with a sufficient safety margin for the system reaction time, both for controlled- and safety shutdown.

c) All valves in drain line from scrubber unit water outlet to overboard, or to holding tank in closed loop systems, shall be confirmed open at all times while the scrubber system is running.

d) Where blocking of filters or other equipment in the discharge line from scrubber units may lead to water build up in scrubber unit, they shall be fitted with differential pressure monitoring.

e) Exhaust collecting pipes (drain pots) as required by [4.1.6] shall be fitted with leakage detection, alarm and shutdown of water supply to the EGC unit.
7.3 Freshwater systems

7.3.1 The exhaust gas cleaning freshwater piping system shall be separated from other freshwater piping systems on board. Connections to other onboard freshwater supply systems are acceptable provided means for prevention of back-flow are arranged.

Guidance note:
A screw-down non-return valve is acceptable provided it is not possible to pump exhaust gas cleaning freshwater back into the onboard freshwater piping system.

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7.3.2 The exhaust gas cleaning system freshwater pumps shall have sufficient capacity for supplying the system at maximum load and without interfering with any essential service on the ship.

7.3.3 Any discharge water piping, including valve(s), shall be protected against corrosion. Distance piece between overboard valve and shell plating shall be of substantial thickness, at least shell plate thickness, but not less than 15 mm.

7.4 NaOH solution systems

7.4.1 The treatment fluid supply system shall be separate from other piping systems on board.

7.4.2 NaOH treatment fluid storage, handling and supply systems pertain to class I piping systems regardless of design pressure (see IACS UR P2).

7.4.3 Materials in tanks and piping systems shall be of a non-combustible material suitable for storage and transportation of the treatment fluid or mixtures thereof. Integral tanks shall have an efficient corrosion prevention system.

Guidance note:
NaOH solutions are incompatible with zinc (including galvanized components), aluminum, magnesium, bronze, brass, copper, tin, chromium, and tantalum and alloys thereof. Non-galvanized carbon steel may, however, be used for air pipes and type approved vent heads with galvanized components are acceptable.

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7.4.4 The plate thickness in free standing NaOH solution tanks shall not be less than 5 mm. For very small tanks, however, the plate thickness may be reduced to 3 mm. Sides and bottom of the tanks shall be well stiffened. Large tanks shall be fitted with wash bulkheads.

7.4.5 Air and sounding pipes to tanks shall be led to open air and shall terminate in such a location that possible spray or fumes do not represent a hazard to personnel. Air pipes should not terminate in a location where fumes from high temperature decomposition of NaOH may render muster stations inaccessible.

Guidance note:
NaOH is toxic at elevated temperatures, e.g. in case of fire.

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7.4.6 Spaces containing tanks and piping systems shall be mechanically ventilated by not less than 6 air changes per hour and piping shall not be led through accommodation or control stations. If located in a separate space, leakage detection systems may be specially considered.

7.4.7 Piping systems shall have all welded connections, except in way of valves or connections to equipment. This requirement is not applicable for drip tray drain lines.
7.4.8 Leakage sources shall be screened so that possible spray does not endanger personnel or may come in contact with heated surfaces, and be provided with spill trays leading to a closed tank. Storage tanks shall not be located above heated surfaces. For the treatment fluid bunker station, alternative arrangements may be accepted if the same or higher level of safety can be ensured. Such an arrangement shall be submitted for approval.

**Guidance note:**
Type approved splash proof cabinets with an integrated spill tray, fitted with leakage detection with corresponding alarm and automatic shut down of inlet and outlet valves to the cabinet, may be fitted with a self-closing drain valve and may be acceptable without drainage to a closed tank depending on the size of the potential leakage.

7.4.9 The drip trays shall be drained to a closed tank. The leakage drain tank and/or drain piping shall be fitted with leakage detection and the drain tank shall at minimum be dimensioned for 125% of the volume of NaOH remaining in the system after shutdown and closing of storage tank valves. Leakage detection shall trigger alarm and shutdown of treatment fluid system and closing of tank valves. The complete leak containment system shall be of materials suitable for NaOH solutions.

7.4.10 Precautions shall be taken against overflow of NaOH solution from the lowest situated drip trays. Drainpipes led to double bottom tanks shall be provided with means for prevention of backflow.

7.4.11 If the drain tank is part of an overflow system, the overflow line and the tank shall be fitted with alarms and drain lines shall be provided with means for prevention of backflow.

7.4.12 Valves fitted below the top of tanks shall for all tank sizes be arranged for quick acting shut-off from a central position outside the space where the tanks are located and at a safe distance from openings to the same space. The controls shall be located separately from the fuel quick acting shut-off valve system controls in order to avoid erroneous operation. Paint, corrosion, etc. shall not impair the efficiency of the remote operation of the valves.

7.4.13 Portable storage tanks up to 1.25 m$^3$ may be used for handling and storage of NaOH, according to the following additional requirements:

a) The tank shall be suitable for storage and handling of NaOH.

b) The tank shall not be arranged for filling, but shall be replaced when empty.

c) The tank shall be fitted in a dedicated space or enclosure protecting it from mechanical damage and able to contain any leakage. The enclosure or openings to the dedicated space shall be located on open deck.

d) Any leakage from the tank and associated fittings shall be led to a closed tank dimensioned for the full capacity of the tank and otherwise arranged according to the requirements for the general leakage containment system. Audible and visual leakage alarm shall be provided outside the compartment adjacent to the entrance and clearly marked with a signboard.

e) The tank drain line shall be arranged for quick acting shut-off at the first point of fixed piping, from a central position outside the space where the tanks are located and at a safe distance from openings to the same space.

7.4.14 The following protective measures shall be provided:

- Eye wash and showers shall be provided in the vicinity of the treatment fluid bunker manifold as well as in the vicinity of, but in a safe distance from treatment fluid pumps. Showers and eye wash may drain to bilge or sanitary discharge systems.
- 3 sets of protective equipment, covering all skin so that no part of the body is unprotected (large aprons, special gloves with long sleeves, suitable footwear, coveralls of chemical resistant material, tight-fitting goggles or face shields or both). The equipment shall be resistant to the treatment fluid in question. The equipment shall be used by personnel during bunkering and in operations which may entail danger to personnel.
- The protective equipment shall be provided in easily accessible lockers outside the accommodation.
— Permanent warning signs shall be fitted.

7.5 Treatment fluid systems other than NaOH

7.5.1 Treatment fluids other than NaOH shall comply with [5.3].

Guidance note:
Magnesium hydroxide (Mg(OH)₂ - milk of magnesia) treatment fluid is not considered hazardous or corrosive in relation to the referenced rules. Such treatment fluids should be handled according to the accompanying material safety data sheet (MSDS), which is not subject for approval. Treatment fluids with high specific weight may require additional strengthening of storage tanks.

---end---of---guide---note---

7.6 Waste and discharge systems

7.6.1 The wash water treatment and monitoring system for the discharge water shall comply with the requirements of IMO Res. MEPC 259(68).

7.6.2 Piping systems and tanks for residues/sludge generated by the exhaust gas cleaning system shall be separate from bilge systems and the normal engine room sludge system, except for a common discharge piping to deck manifold.

8 Additional qualifiers Enhanced and Zero discharge

8.1 Enhanced

8.1.1 The Enhanced qualifier may be assigned to an emission reduction system designed in accordance with this subsection in addition to the requirements for relevant system qualifier.

8.1.2 General

8.1.2.1 The emission reduction system shall be designed and arranged according to the principles of Pt.4 Ch.1 as for a system serving a main function.

Guidance note:
Emission reduction units are not considered an active component in relation to this qualifier.

---end---of---guide---note---

8.1.2.2 For ships designed to comply with the rules for redundant propulsion or dynamic positioning, the emission reduction units and associated systems shall be designed according to the principles of Ch.2 Sec.7, Ch.3 Sec.2 or Ch.3 Sec.1. For notations requiring fully separated engine rooms (e.g. DYNPOS(AUTRO), DPS(3), RP(3, x)), each side shall be provided with a separate emission reduction system and any common piping shall have isolation valves at the bulkhead on both sides.

8.1.3 Piping systems and components

8.1.3.1 Pumps serving an emission reduction system with Enhanced qualifier, where the failure of the pump may reduce the capacity of the system, shall be arranged with redundancy.

8.1.3.2 Sea-water supply systems for systems with EGCS open and EGCS hybrid qualifiers shall be connected to at least two sea-water inlets, preferably on opposite sides of the ship. The same applies for cooling systems with EGCS closed qualifier.
8.1.3.3 Sea-water supply suction lines for systems with **EGCS pen**, **EGCS hybrid** and **EGCS closed** qualifiers shall be provided with strainers which can be cleaned without interrupting the water supply. The same applies to any filter in the system which cannot be cleaned with the system in operation.

8.1.3.4 EGCS units (any type) shall be provided with works (W) certificate for the scrubber unit material and the welding of joints shall be carried out by qualified welders using approved welding procedure specifications and type approved welding consumables, see Pt.2 Ch.4.

### 8.1.4 Electrical systems

8.1.4.1 Electrical systems serving an emission reduction system with **Enhanced** qualifier shall be arranged as required for important systems according to Pt.4 Ch.8 Sec.1 [2.3.2].

### 8.1.5 Control and monitoring systems

8.1.5.1 Control and monitoring systems serving an emission reduction system with **Enhanced** qualifier shall be arranged as required for essential systems according to Pt.4 Ch.9.

8.1.5.2 The control system shall be arranged with sufficient redundancy so as to prevent loss of the emission reduction function or multiple cleaning units upon a single failure.

8.1.5.3 The shutdown conditions listed in the tables in [9.2.1], [9.3.2] and [9.4.3] as relevant for the selected qualifier(s), shall be designed or grouped as to minimize the effect of the shutdown on the emission reduction functionality. A cause and effect diagram shall be submitted to this effect for all shutdown signals listed in the relevant table. Any other condition in the emission reduction installation causing automatic shut-down of the system beyond what is required according to these rules shall also be identified and analysed in the cause and effect diagram. Any such condition shall be alarmed.

**Guidance note:**
This may be achieved e.g. by only shutting down water supply to individual sections of the EGC system on installations with multiple units, or only shutting down the affected part of the system if possible.

---e-n-d-o-f-g-u-i-d-a-n-c-e-n-o-t-e---

### 8.2 Zero Discharge

8.2.1 The **Zero discharge** (x) qualifier may be assigned to an EGR, EGCS hybrid and EGCS closed emission reduction system designed in accordance with this subsection, capable of maintaining no discharge of wash-water to sea for a number of days given by the parameter x.

### 8.2.2 General

8.2.2.1 The bleed off discharge system shall be arranged with facilities for holding the accumulated bleed off water for a defined number (given by the parameter x) of days at full load as defined for the emission reduction system in the sulfur emissions compliance plan (SECP).

**Guidance note:**
The system is, however, likely to be able to operate for longer time periods in zero discharge mode at lower machinery load.

---e-n-d-o-f-g-u-i-d-a-n-c-e-n-o-t-e---

8.2.2.2 The holding tank shall be suitable for the retention of the treated wash-water. If the tank is a structural tank, the water shall be treated to minimum pH 6 before transfer to the holding tank(s).
8.2.2.3 Facilities shall be provided for discharge of treated wash-water to deck manifold. Piping systems and tanks for treated wash-water shall be separate from the systems for residues/sludge generated by the EGCS as well as from bilge systems and the normal engine room sludge system, except for a common discharge piping to deck manifold.

9 Control and monitoring

9.1 General

9.1.1 The control and monitoring system shall comply with, and be documented according to, the requirements of Pt.4 Ch.9.

Guidance note:
The EG, EGR and/or SCR control and monitoring system is considered to be an important control system in the context of Pt.4 Ch.9.

9.1.2 All alarms related to the emission reduction installation shall be routed to a permanently manned location, and be presented as individual alarms or alarm groups.

9.1.3 The required safety shutdown functions for the emission reduction installation shall be implemented in a safety system that is independent of the control and monitoring system, in line with the principles of Pt.4 Ch.9. This includes all required signals related to shutdown (automatic and manual) of the emission reduction system and operation of bypass valves, if installed.

9.1.4 For ships with class notation E0 (periodically unattended machinery space), any alarm and/or shutdown condition in the exhaust gas cleaning system shall be relayed to the vessels extension alarm system.

9.1.5 The exhaust gas cleaning unit system shall be arranged for emergency stop from the control station of the exhaust gas cleaning unit and in ECR when provided. Activation of emergency stop shall cause immediate stop of all active components in the exhaust gas cleaning system and shall not lead to stop of the engine installations served. The emergency stop signals may be implemented in the scrubber safety system, and shall comply with the requirements in Pt.4 Ch.8.

Guidance note:
This should be arranged with direct tripping of supply breaker or tripping through the control power circuit for the circuit breaker. Alternative arrangements independent of the software based control system may be accepted (e.g. pulse blocking, disconnection of control voltage to pulse amplifiers). Injection purging systems on SCR system may remain in operation if necessary to prevent damage to equipment during shutdown.

9.2 Exhaust bypass- and blocking arrangements

9.2.1 Where installed, bypass or blocking exhaust damper arrangements shall be monitored as listed in Table 7. Indicators and alarms shall be provided at the control station for the emission reduction system.

Table 7 Control and monitoring for exhaust bypass- and blocking arrangements

<table>
<thead>
<tr>
<th>System</th>
<th>Item</th>
<th>Gr 1 Indication and alarm</th>
<th>Gr 2 Shut down with alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass arrangements</td>
<td>See [4.2.2][1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 9.3 SCR Systems

**9.3.1** Control and monitoring systems as specified in MARPOL Annex VI Regulation 13 / NO\textsubscript{x} Technical Code related to performance are subject to verification when the Society is authorised to issue the IAPP certificate under MARPOL Annex VI.

**9.3.2** SCR units shall be monitored as listed in Table 8 or Table 9, as applicable for the treatment fluid in question. Indicators and alarms shall be provided at the control station for the exhaust gas cleaning unit.

#### Table 8 Control and monitoring for urea based SCR systems

<table>
<thead>
<tr>
<th>System</th>
<th>Item</th>
<th>Gr 1 Indication and alarm</th>
<th>Gr 2 Shut down with alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment fluid supply system</td>
<td>Supply pressure or flow</td>
<td>IR, LA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply temperature\textsuperscript{2)}/</td>
<td>HA, LA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tank level \textsuperscript{3)}</td>
<td>IR, HA\textsuperscript{3)}</td>
<td>LA</td>
</tr>
<tr>
<td></td>
<td>Tank temperature \textsuperscript{4)}</td>
<td>IR, HA, LA</td>
<td></td>
</tr>
<tr>
<td>Exhaust gas system</td>
<td>Pressure drop across unit\textsuperscript{5)}</td>
<td>HA, SH</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature before unit</td>
<td>IR, HA, LA, SH</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature after unit\textsuperscript{6)}</td>
<td>IR, HA, SH\textsuperscript{1)}</td>
<td></td>
</tr>
<tr>
<td>Ammonia slip\textsuperscript{7)}</td>
<td>Ammonia slip</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Control / alarm/ monitoring / safety</td>
<td>Power failure</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>
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Environmental protection and pollution control

Environmental protection and pollution control

DNV GL AS

### Table 9 Control and monitoring for non-urea based SCR systems

<table>
<thead>
<tr>
<th>System</th>
<th>Item</th>
<th>Gr 1 Indication and alarm</th>
<th>Gr 2 Shut down with alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build-up of liquid in exhaust gas cleaning system</td>
<td>Level high</td>
<td>HA</td>
<td>SH</td>
</tr>
<tr>
<td>Treatment fluid supply system</td>
<td>Supply pressure or flow</td>
<td>IR, LA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply temperature</td>
<td>HA, LA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tank level</td>
<td>IR, HA, LA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tank temperature</td>
<td>IR, HA, LA</td>
<td></td>
</tr>
<tr>
<td>Exhaust gas system</td>
<td>Pressure drop across unit</td>
<td>HA</td>
<td>SH</td>
</tr>
<tr>
<td></td>
<td>Temperature before unit</td>
<td>IR, HA, LA</td>
<td>SH 6)</td>
</tr>
<tr>
<td></td>
<td>Temperature after unit</td>
<td>IR, HA 1)</td>
<td>SH 1)</td>
</tr>
<tr>
<td></td>
<td>Exhaust gas fans</td>
<td>IR</td>
<td></td>
</tr>
<tr>
<td>Ammonia slip</td>
<td>Ammonia slip</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Control / alarm/ monitoring / safety</td>
<td>Power failure</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>
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System | Item | Gr 1 Indication and alarm | Gr 2 Shut down with alarm
---|---|---|---
Gr 1 = Sensor(s) for indication, alarm (common sensor permitted).
Gr 2 = Sensor for shut down connected to the safety system.
IR = Remote indication (presentation of values), in engine control room or another centralized control station.
A = Alarm activated for logical value.
LA = Alarm for low value.
HA = Alarm for high value.
SH = Shut down and opening of bypass with corresponding alarm.

1) If required by [2.2.1], the system shall give alarm before the tolerance temperature of internal components is reached and trigger automatic bypass if the temperature is exceeded. Alternatively a separate cooling system for the components may be fitted if arranged with low supply pressure alarm and redundancy.
2) If such build up is possible within the system (includes intermediate tanks), shall give alarm if treatment fluids enters the machinery it serves.
3) Applicable for systems with heat tracing.
4) Includes intermediate tanks if installed.
5) Alarm shall be activated before the back-pressure exceeds the maximum allowable for the engine installations served.
6) For system where exhaust gas inlet temperature is essential. SHD at low-low AND high-high level.
7) Indication of soot fire.
8) If fans are installed. Indication of operational status.
9) Ref MEPC.198(62) - 3.3.1 Measures to prevent ammonia slip shall be provided. See also guidance note for [5.3.8].
10) May not be served by the SCR control and monitoring system.

9.4 EGC Systems

9.4.1 The emission control and monitoring system as specified in IMO Res. MEPC.259(68), shall comply with the requirements of Pt.4 Ch.9 when the Society is authorised to issue the IAPP certificate. (the Society is recognised organisation for MARPOL Annex VI).

9.4.2 The emission control and monitoring systems as specified in IMO Res. MEPC.259(68) related to environmental performance are subject to verification when the Society is authorised to issue the IAPP certificate under MARPOL Annex VI.

9.4.3 Exhaust gas cleaning units shall be monitored as listed in Table 10. Indicators and alarms shall be provided at the control station for the exhaust gas cleaning unit.

Guidance note:
Additional parameters to monitor and record are described in IMO Res. MEPC.259(68).

---end---of---guide---ance---note---

Table 10 Control, monitoring and recording for EGC systems

<table>
<thead>
<tr>
<th>System</th>
<th>Item</th>
<th>Gr 1 Indication and alarm</th>
<th>Gr 2 Shut down with alarm</th>
<th>Data to be recorded according to MEPC.259(68)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build-up of liquid in EGC system or unit</td>
<td>Level in I-type or similar EGC unit(s)</td>
<td>HA, SH</td>
<td>SH</td>
<td></td>
</tr>
<tr>
<td>System</td>
<td>Item</td>
<td>Indication and alarm</td>
<td>Shut down with alarm</td>
<td>Data to be recorded according to MEPC.259(68)</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------</td>
<td>-----------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td><strong>Exhaust gas cleaning wash water systems</strong></td>
<td>Level in U-type or similar EGC unit(s)</td>
<td>HA</td>
<td>SH</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level in drain pot for I-type or similar EGC unit(s)</td>
<td>SH</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level in intermediate tanks for open loop</td>
<td>HA, SH</td>
<td>SH</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level in intermediate tanks only used for closed loop mode</td>
<td>HA, SH</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply pressure</td>
<td>IR, LA</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>HA, LA</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flow rate</td>
<td>IR</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>pH, washwater</td>
<td></td>
<td>R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PAH, washwater</td>
<td></td>
<td>R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Turbidity, washwater</td>
<td></td>
<td>R</td>
<td></td>
</tr>
<tr>
<td><strong>NaOH fluid supply system</strong></td>
<td>Leakage detection</td>
<td>SH&lt;sup&gt;11&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply temperature (for pipes fitted with heat tracing)</td>
<td>HA, LA</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NaOH treatment fluid tanks</strong></td>
<td>Level in storage tank only filled from bunker manifold</td>
<td>IR, HA, LA</td>
<td>HA&lt;sup&gt;10&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level in tanks filled by transfer pumps</td>
<td>IR, HA, LA</td>
<td>SH&lt;sup&gt;9&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>IR, HA, LA</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other hazardous treatment fluid supply system</strong></td>
<td>Leakage detection</td>
<td>SH&lt;sup&gt;11&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply temperature</td>
<td>HA, LA</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other hazardous treatment fluid tanks</strong></td>
<td>Level</td>
<td>IR, HA, LA</td>
<td>HA&lt;sup&gt;10&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>IR, HA, LA</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Exhaust gas system</strong></td>
<td>Pressure drop across unit</td>
<td>IR</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pressure before unit</td>
<td>HA</td>
<td>SH&lt;sup&gt;4&lt;/sup&gt;</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>Temperature before unit</td>
<td>IR, HA</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature after unit</td>
<td>IR, HA&lt;sup&gt;2&lt;/sup&gt;</td>
<td>SH&lt;sup&gt;2&lt;/sup&gt;</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>Exhaust gas fans run</td>
<td>IR</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control / alarm/ monitoring / safety</strong></td>
<td>Power failure</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Valve position (For I type or similar EGC unit(s))</td>
<td>SH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System</td>
<td>Item</td>
<td>Gr 1 Indication and alarm</td>
<td>Gr 2 Shut down with alarm</td>
<td>Data to be recorded according to MEPC.259(68)</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------</td>
<td>---------------------------</td>
<td>----------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Control air pressure</td>
<td>LA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilge system</td>
<td>Level 7)</td>
<td>SH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel oil combustion units</td>
<td>Load</td>
<td>R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust gas emission</td>
<td>SO₂ (ppm)</td>
<td>R</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CO₂ (%)</td>
<td>R</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Gr 1 = Sensor(s) for indication, alarm and shutdown (common sensor permitted).
Gr 2 = Separate sensor for shut down or alarm, connected to the safety system.
IR = Remote indication (presentation of values), in engine control room or another centralized control station.
A = Alarm activated for logical value.
LA = Alarm for low value.
HA = Alarm for high value.
SH = Shut down and opening of bypass with corresponding alarm.
R = Parameter to be recorded according to MEPC.259(68) when required, see [9.4.2].

1) If required by [2.2.1], the system shall give alarm before the tolerance temperature of internal components is reached and trigger automatic bypass if the temperature is exceeded. Alternatively a separate cooling system for the components may be fitted if arranged with low supply pressure alarm and redundancy.
2) Not applicable for EGC units without bypass on one or more connected machinery systems according to [4.1.2]. On such installations the automatic cleaning system shall start before the Gr 1 alarm limit is reached (if the automation is based on back pressure or pressure drop across unit).
3) In the event the temperature may impact personnel safety, alarms shall be provided for high temperature and also low temperature as found relevant. High temperature alarm is required where fitted with tank heating arrangements, low temperature is required dependent on tank location and arrangement. Treatment fluid supply temperature monitoring may be replaced by tank temperature monitoring if heat tracing is not fitted.
4) Alarm to indicate soot fire.
5) If fans are installed. Indication of operational status.
6) Alarm shall be activated before the back-pressure exceeds the maximum allowable for the engine installations served. May be served by the same sensor as for pressure drop recording.
7) A bilge level switch shall be fitted in the space containing scrubber and associated piping system. The trigger level shall be at a suitable height above main class bilge alarm level, if applicable, and trigger immediate shutdown of pumps.
8) Sensor(s) shall be arranged in any location necessary to protect temperature sensitive discharge piping, supply piping and/or scrubbing unit internal components from temperatures exceeding the component rating. In case low water temperature may affect scrubber function, low temperature alarm is required.
9) Shut down of NaOH pumps and valves on tank outlets, if drainage system is designed according to [7.2.12].
10) Separate sensor connected to the control system is acceptable.
11) Only required for systems designed in accordance with [7.4.9].
10 Surveys and testing

10.1 General

10.1.1 Testing of piping systems shall be performed in accordance with Pt.4 Ch.6 Sec.10.

10.1.2 Free standing tanks for hazardous or corrosive treatment fluids shall be tested for the maximum filling level with a test fluid of same or higher specific weight.

10.2 SCR systems

10.2.1 The exhaust gas cleaning system is subject to a function and safety test after installation onboard. The test shall include control and monitoring systems as well as the electrical power supply. The test shall be performed with all engine installations running.

10.2.2 SCR systems shall also be tested in accordance with the requirements of MARPOL Annex VI Regulation 13/NOx Technical code, as applicable.

Guidance note:
Where the Society is authorised to issue the IAPP certificate under MARPOL Annex VI, this is considered to fall within the scope of the Society.

10.3 EGR and EGC Systems

10.3.1 Test procedure for quay and sea trial
The exhaust gas cleaning system is subject to a function and safety test after installation onboard. The test shall include control and monitoring systems as well as electrical power supply. The test shall be performed with all engine installations running.

10.3.1.1 The test procedure shall give detailed procedures for testing of the following items:
— Where a bypass arrangement is installed this shall be verified to fail to safe mode (bypass open) upon loss of power.
— Where an oil burner is installed the flame failure switch shall be tested.
— Drainage capacity of EGC unit shall be verified at full water supply capacity.

10.3.1.2 For systems utilizing hazardous treatment fluids, e.g. NaOH, the test procedure shall give detailed procedures for testing of the following items:
— All drip trays and drainage tanks shall be installed prior to filling the system with the treatment fluid.
— Quick acting shut off valve system shall be tested when applicable.
— Drip tray arrangements including material selection, alarm and/or drainage to closed tank shall be verified according to the rules.
— Condition of screening of possible leakage sources shall be verified.
— Where installed, the functionality of the ventilation system and leakage detection in the storage space shall be verified.
— Personal protection equipment and measures, as required for the treatment fluid, shall be verified in place.

10.3.1.3 For control and monitoring systems, the test procedure shall give detailed procedures for testing of the following items:
— Test of emergency stop.
— Test of independent safety system, verifying EGCS shutdown/pump stop with alarm for the required values in column Gr 2 in Table 10.
— Test of automatic stop (with alarm) of water supply pumps in case of high level in the EGC unit.
— Test of alarm sensors.
— Test of normal operation: start/stop; standby start/stop (as applicable); manual operation (as applicable); automatic restart (without manual intervention) of EGCS C&M, wash water system and exhaust gas analyzer when recover from total loss of power and start interlock.
— Alarm handling: interface to vessels IAS (as applicable); EGCS alarm transfer to the vessels main alarm system, and to the vessels extension alarm system in case of operation during unattended machinery space; alarm in case of no water flow through the wash water monitoring system during scrubber operation.
— Failures to initiate alarm: loss of communication; loss of power; broken wire; I/O module failure; redundancy test (as applicable); HMI failure; failure in CEMS (SO\textsubscript{2}/CO\textsubscript{2} analyzer); failure in water monitoring system; failure in GPS.
— Data-logger (MEPC): report generation and download of data.
— Verify software numbers and version.
— Workmanship: wiring and cabling; labelling and marking of components; earth connection.

**10.3.2** EGC systems (and EGR systems operated on non-compliant fuel) shall also be tested in accordance with the requirements of IMO Res. MEPC.259(68).

**Guidance note:**
Where the Society is authorised to issue the IAPP certificate under MARPOL Annex VI, this is considered to fall within the scope of the Society.

---end---of---g-u-i-d-a-n-c-e---n-o-t-e---

**10.3.3** EGR systems shall also be tested in accordance with the requirements of MARPOL Annex VI Regulation 13/NO\textsubscript{x} Technical Code, as applicable.

**Guidance note:**
Where the Society is authorised to issue the IAPP certificate under MARPOL Annex VI, this is considered to fall within the scope of the Society.

---end---of---g-u-i-d-a-n-c-e---n-o-t-e---
SECTION 8 EXTERNAL AIRBORNE NOISE EMISSION – QUIET

1 General

1.1 Introduction
Airborne noise pollution is an important part of the environmental impact of ships, where it may affect living, working and leisure areas near ports. The overall external airborne noise emission radiated from a ship can be traced back to several individual sources. Based on experience, the most relevant external sources of noise are funnel outlets of the engines, the openings of engine room ventilation inlets and outlets and the openings of the cargo holds- and accommodation ventilation and air-conditioning. There is an increasing need to be able to document the actual noise emitted from a vessel berthed in a port, in idle or under working conditions. This, to satisfy port authority and/or in order to qualify for reduced port fees.

1.2 Objective
The objective of the additional class notation Quiet is to present the vessels external airborne noise emission during port stays based upon a realistic but practically feasible measurement methodology.

1.3 Scope
The scope of this section covers test procedure and measuring methodology under defined operating conditions to allow for demonstration of controlled airborne noise emission.
It include requirements to ensure that vessels can be tested for external noise emission in idle- and working condition while in port.

1.4 Application
The additional class notation Quiet applies to all vessels to address the environmental impact of airborne noise emission.
1.5 Class notations

Vessels built in compliance with the requirements as specified in Table 1 may be assigned the class notation Quiet.

**Table 1 Class notation and qualifiers**

<table>
<thead>
<tr>
<th>Class notation</th>
<th>Qualifier</th>
<th>Purpose</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiet</td>
<td>I[\text{L}_s, \text{L}_p, d, h]</td>
<td>Establishing measuring methodology for assessing airborne noise emitted from vessels when berthed.</td>
<td>Vessels berthed in port in idle condition. ( \text{L}_s ) - maximum A-weighted sound pressure level in dB(A) on starboard side on a 100 m distance. ( \text{L}_p ) - maximum A-weighted sound pressure level in dB(A) on port side on a 100 m distance. ( d ) - maximum difference between C-weighted and A-weighted sound pressure level in dB on a 100 m distance. ( h ) - height of funnel in m, if any.</td>
</tr>
<tr>
<td>W[\text{L}_s, \text{L}_p, d, h]</td>
<td>Vessels berthed in port in working condition. ( \text{L}_s ) - maximum A-weighted sound pressure level on starboard side on a 100 m distance. ( \text{L}_p ) - maximum A-weighted sound pressure level on port side on a 100 m distance. ( d ) - maximum difference between C-weighted and A-weighted sound pressure level. ( h ) - height of funnel in m, if any.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.6 Definitions and terms

1.6.1 Symbols

Relevant acoustic quantities, their symbols and corresponding SI units are stated in Table 2.

**Table 2 Applied acoustic quantities and symbols**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Symbol</th>
<th>Unit of measurement</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound pressure</td>
<td>( p )</td>
<td>Pa</td>
<td></td>
</tr>
<tr>
<td>Sound pressure level</td>
<td>( \text{L}_p )</td>
<td>dB ref. 20 ( \mu )Pa</td>
<td>( \text{L}<em>p = 10 \cdot \log</em>{10} \left( \frac{p_{\text{r.m.s.}}}{p_{\text{ref}}} \right)^2 = 20 \cdot \log_{10} \left( \frac{p_{\text{r.m.s.}}}{p_{\text{ref}}} \right) )</td>
</tr>
<tr>
<td>Root mean square of sound pressure</td>
<td>( p_{\text{r.m.s.}} )</td>
<td>Pa</td>
<td></td>
</tr>
<tr>
<td>Reference sound pressure</td>
<td>( p_{\text{ref}} )</td>
<td>Pa</td>
<td>( = 20 ) ( \mu )Pa</td>
</tr>
<tr>
<td>A-weighted sound pressure level</td>
<td>( \text{L}_{pA} )</td>
<td>dB(A)</td>
<td>A-weighting filter according to IEC 61672-1:2014</td>
</tr>
</tbody>
</table>
### Table 3 External references

<table>
<thead>
<tr>
<th>Document code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 31/VII</td>
<td>Quantities and units of acoustics</td>
</tr>
<tr>
<td>ISO 1996-1:2007</td>
<td>Acoustics – Description and measurement of environmental noise – Part 1: Basic quantities and procedures</td>
</tr>
<tr>
<td>ISO 3744:2010</td>
<td>Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane</td>
</tr>
<tr>
<td>ISO 3746:2010</td>
<td>Determination of sound power levels of noise sources using sound pressure-survey method using an enveloping measurement surface over a reflecting plane</td>
</tr>
<tr>
<td>ISO 3747:2010</td>
<td>Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering/survey methods for use in situ in a reverberant environment</td>
</tr>
<tr>
<td>ISO 9614-1:1993</td>
<td>Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 1: Measurement at discrete points</td>
</tr>
<tr>
<td>ISO 9614-2</td>
<td>Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scanning</td>
</tr>
<tr>
<td>ISO 80000-8</td>
<td>Quantities and units - Part 8: Acoustics</td>
</tr>
</tbody>
</table>
2 Documentation

2.1 Documentation requirements

2.1.1 Documentation shall be submitted as required by Table 4.

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
</table>
| External noise    | Z255 - Measurement procedure | A detailed plan for the measurements prior to execution, containing:  
|                   |                          | — geographical location for planned measurements (several alternatives may be presented)  
|                   |                          | — description of distances to reflecting bodies at the measurement location  
|                   |                          | — description of planned measurement set-up. i.e. location of measurement positions, planned mooring location and details of instrumentation to be used  
|                   |                          | — description of the expected operating profile for the vessel  
|                   |                          | — detailed specification of vessel’s intended operating conditions relevant for the external noise emitted from the vessel during the measurements, number of generators running, ventilation fans, and other noise sources relevant for external noise emission  
|                   |                          | — description of method(s) to be used for monitoring operating conditions  
|                   |                          | — expected loading condition during the measurements and normal range of loading conditions for the vessel  
|                   |                          | — description of any intended deviations from the required measuring procedure, operating conditions or loading conditions.                                                                                       | AP   |
|                   | Z266 - Measurement report | Including:  
|                   |                          | — detailed observed operating conditions during the tests, i.e.:  
|                   |                          | — engines in operation and corresponding load/speed  
|                   |                          | — engine room fans in operation and corresponding load/speed  
|                   |                          | — other relevant noise sources in operation.  
|                   |                          | — weather conditions  
|                   |                          | — graphical description of measuring site and location of measurement positions  
|                   |                          | — measured sound pressure levels and calculated results.                                                                                               | AP   |

AP = For approval
2.1.2 For general requirements to documentation, see DNVGL-CG-0550 Sec.6.

2.1.3 For a full definition of the documentation types, see DNVGL-CG-0550 Sec.5.

3 Measurements and testing

3.1 Measurement procedures

3.1.1 The external noise emission shall be verified through measurements and submitted documentation complying with the requirements specified herein.

3.1.2 The measurements shall be executed by a company approved by the Society or by the Society. In the former case, the measurements shall be witnessed by a surveyor representing the Society. The company shall be able to demonstrate proven capability in airborne noise measurements and should be in possession of necessary high precision instrumentation, see [3.2.1] - [3.2.3].

3.1.3 The external noise levels shall be measured in a port or another suitable site approved by the Society before the measurements are initiated.

3.1.4 The noise emission can either be measured externally at a distance of 100 m from the vessel (far field measurements) or by local source measurements which then are used to calculate the resulting external noise at 100 m (individual source measurements). The measurement procedures are described in DNVGL-CG-0313 Sec.3. Other measurement procedures may be accepted on a case by case basis.

3.2 Test equipment

3.2.1 Integrating sound level meter with a microphone, cable, and windscreen, in compliance with performance category class 1 of IEC 61672-1 and IEC 61672-2 shall be used.

3.2.2 Sound calibrators shall comply with the standard IEC 60942 and shall be approved by the manufacturer of the sound level meter used. Calibrator and sound level meter shall have been calibrated maximum two years prior to the test by a national standard laboratory or a competent laboratory accredited according to ISO/IEC 17025.

3.2.3 The microphone shall be equipped with a windscreen with diameter larger or equal to 6 cm. The wind screen should not affect the measurement level of similar sounds by more than 0.5 dB(A) in "no wind" conditions.

3.2.4 All distances required for far field measurements shall be measured with a measuring device with an accuracy of +/- 2 m or better within the range of 50 to 200 m.

3.2.5 A pod, tripod or equivalent equipment that are long enough to be able to carry out noise measurements at least 3.5 m above the sea surface shall be used for far field measurements

3.2.6 A camera for taking still images shall be used to document the vessel and measurement set-up.

3.2.7 Instruments measuring wind speed (anemometer), wind direction (wind vane/sock) at the height of 10 m or higher in free field (with 10% accuracy or better), temperature, barometric pressure and humidity may be used. Alternatively, these weather data may be measured by the ship installed weather system and recorded by the ship crew during the measurements.
3.3 Post-processing software

3.3.1 For post-processing, analysis software is required comprising the following methods:
— third-octave band analysis according to IEC 61672-1.
— frequency weighting, time weighting and averaging.

3.4 Test conditions

3.4.1 Specification of the vessel’s operating conditions during the measurements shall be submitted to the Society for approval prior to the testing. The specification shall at least contain the information specified in Table 4.

3.4.2 The vessel's operating conditions during the measurements shall adhere to the requirements given in one or both of [3.4.2.1] and [3.4.2.2], depending on the type of operation for which the vessel shall be tested. The class notation is valid only for the tested operating conditions or any other equivalent operating conditions of the vessel.

3.4.3 Vessels with qualifier I shall be tested for a defined set of operating conditions which represent typical or expected operating conditions for the vessel's idling condition in port.

3.4.4 Vessels with qualifier W shall be tested for a defined set of operating conditions which represent typical or expected operating conditions for the vessel's working conditions in port.

3.4.5 The vessel's operating conditions shall be monitored during the measurements and the information specified in Table 4 shall as a minimum be recorded as accurately as practical during the measurements, see also DNVGL-CG-0313 Sec.3.

3.4.6 All equipment and systems shall be running at their normal rated capacity or in the normal mode for the operation in question.

3.5 Reporting

3.5.1 The measured apparent source levels shall be reported in dB(A) and dB(C). The expected content of the measurement report is presented in DNVGL-CG-0313 Sec.3.

3.5.2 The Society will assess the reported results, documented vessel's operating conditions during the measurements and any other relevant information. If the measurement report is approved, the relevant Quiet class notation with qualifiers will be assigned.
CHANGES – HISTORIC

July 2018 edition

Changes July 2018, entering into force 1 January 2019

<table>
<thead>
<tr>
<th>Topic</th>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>New class notation for SO$_x$ and NO$_x$ cleaning systems (Scrubbers and SCR systems)</td>
<td>Sec.7</td>
<td>New subsection on additional class notation ER (emission reduction).</td>
</tr>
</tbody>
</table>

January 2018 edition

Changes January 2018, entering into force 1 July 2018

<table>
<thead>
<tr>
<th>Topic</th>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>App.A [4]</td>
<td>Addition of simplified measurement method based on through the hull pressure measurements. Based on internal and co-operative research a simplified measurement method has been included as an alternative way to verify SILENT compliance. The method is based on experience from a number of full scale measurements as well as a dedicated CRS (Co-operative research ship) research project, ref. DNV GL report no. 2016-0640.</td>
</tr>
<tr>
<td>Underwater noise</td>
<td>Sec.6 [1.5]</td>
<td>Harmonization of definitions with ISO 17208-1.</td>
</tr>
<tr>
<td></td>
<td>Sec.6 [3.1.7]</td>
<td>Test condition reduced from 85% MCR to 80% MCR to bring it in line with the required test condition in the now mandatory IMO MSC 337(91) code on noise levels onboard ships.</td>
</tr>
</tbody>
</table>

July 2017 edition

This document supersedes the January 2017 edition of DNVGL-RU-SHIP Pt.6 Ch.7.
## Changes July 2017, entering into force 1 January 2018

<table>
<thead>
<tr>
<th>Topic</th>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimization of the Documentation requirements</td>
<td>Sec.1 Table 2</td>
<td>Revised documentation requirements:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— Arrangement plan for sampling points have been removed. Sampling points to be included in the S010 Piping diagram.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— I220 Interphase description has been removed and information about remote and transfer control shall be included in the BWM plan.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— Instrument and equipment list, piping diagram, data sheet, arrangement drawing and operation manual for filling procedures are removed from the specific components (BWM system technologies). The same information shall anyway be included in the Z161 operation manual for the ballast water treatment system. A piping diagram for electrolysers and ozone systems or arrangement drawing for chemical systems and neutralization are still required and shall cover all necessary details.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— a structural drawing is only required for chemical tanks containing hazardous chemical, and has thus been removed for neutralization systems which are always a non-hazardous chemicals.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— Corrosion reports are covered by GESAMP final approval and is not the responsibility of the Society when the system is type approved. Information is required for the operation manual if corrosion issues are expected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— A hazardous area classification drawing is included as a requirement for ozone and chemical injection systems due to potential hazardous atmosphere.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— New control system documentation requirements for safety system has been introduced based on the revised G8.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— Requirements for a valid type approval certificate have been removed from Table 3 and inserted in a new Table 4. Pressure equipment product certificate has been included as a document requirement. Pt.4 Ch.7 shall still be used for defining pressure vessels.</td>
</tr>
<tr>
<td>Implementation revised G8, MEPC 279 (70)</td>
<td>Sec.1 [3.2.4]</td>
<td>Required on-board documentation included and aligned with G8. The vessel shall be provided with:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— a ballast water record book</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— operation, maintenance and safety manual approved by the administration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— type approval certificate of the BWMS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— installation specifications (i.e. copy of approved drawings, P&amp;ID)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— an approved installation commissioning procedure specific to the BWM system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— a copy of the approved ballast water management plan (developed according to the G4 guideline of the convention including details on the BWM system and operation of the BWM system).</td>
</tr>
<tr>
<td>Sec.1 [1.6]</td>
<td></td>
<td>Based on the requirement in Sec.1 [3.2.4] for commission test, the requirements for initial survey have been removed and replaced by Sec.1 [1.6].</td>
</tr>
<tr>
<td>Sec.1 [3.3.2.4]</td>
<td></td>
<td>Added new requirement from revised G8: Any moving parts, which are fitted in hazardous areas, shall be arranged so as to avoid the formation of static electricity.</td>
</tr>
<tr>
<td>Topic</td>
<td>Reference</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td>Sec.1 [3.3.1.3], Sec.1 [3.4.3.2], Sec.1 [3.4.3.8], Sec.1 [3.4.4.10] and Sec.1 [3.4.5.3]</td>
<td>To be aligned with the requirement for a redundant safety system, all previous required independent and/or immediate shut downs are now defined as safety systems independent of the BWM control system.</td>
</tr>
<tr>
<td></td>
<td>Sec.1 [3.4.4.6], Sec.1 [3.4.3.7], Sec.1 [3.4.3.10], Sec.1 [3.4.3.11]</td>
<td>Based on G8 4.5 and to align with other requirements to chemicals, requirements for material, secondary containers, drip trays and leak detection has been implemented.</td>
</tr>
<tr>
<td></td>
<td>Sec.1 [3.4.4.10], Sec.1 [3.4.5.3]</td>
<td>Based on G8 4.5 two means of independent detection and shutdown are required.</td>
</tr>
<tr>
<td></td>
<td>Sec.1 [4.5.5]</td>
<td>Based on G8 4.17, 7.2 and 7.3 Automation requirements has been updated.</td>
</tr>
</tbody>
</table>

**January 2017 edition**

**Main changes January 2017, entering into force as from date of publication**

- **Sec.1 Ballast water management - BWM**
  - Sec.1 [2.6.1] and Sec.1 [2.4.2]: Ballast water management plans including sequential exchange of ballast water will not be required to include detailed calculations if an approved loading computer is onboard. In case a detailed calculation is to be submitted, only the most critical condition need to be included.

- **Sec.2 Environmental class - Clean**
  - Sec.2 [1.1] and Sec.2 [1.2]: Qualifiers for the class notation Clean are added: Clean(Tier III) and Clean(Design,Tier III).

- **Sec.3 Fuel and lubrication oil systems and arrangement for meeting regulations in emission control areas - ECA**
  - Sec.3 [1.3]: Sentence included to ensure that ECA SOx notation formally can be given to e.g. ships with gas fuel or scrubbers.

**July 2016 edition**

This document supersedes the January 2016 edition.

**Main changes July 2016, entering into force 1 January 2017**

- **Sec.1 Ballast water management - BWM**
  - Sec.1 Table 2: In accordance with 5.1.9 of IMO G8, the commissioning procedure (Z254) is changed from FI to AP and shall be approved in accordance with Sec.1 [3.3], Sec.1 [3.4] and Sec.1 [3.5].
  - Sec.1 [3.3] and Sec.1 [3.4]: The sub-sections are updated to cover IACS UR M74.
— Sec.1 [3.3.1][1]: The paragraph is updated for further clarification and a guidance note has been included.
— Sec.1 [3.3.1][2]: The paragraph is updated to further clarify compliance requirements with Pt.4 Ch.6 Sec.2.
— Sec.1 [3.4.3][5]: The paragraph is updated to follow DNV GL rules for ozone detection found in Pt.4 Ch.6 Sec.7.
— Sec.1 [3.4.5][1]: The paragraph is updated for further clarification with regards to the ventilation.
— Sec.1 [3.5.1][8]: A new paragraph is included to cover 5.1.9 and 8.2.6 of IMO G8.

• Sec.2 Environmental class - Clean
  — Sec.2 Table 4: References updated from DNV programmes to DNV GL programmes.
  — Sec.2 [2.3.8][2]: Change in reference has been made.

**January 2016 edition**

This document supersedes the October 2015 edition.

**Main changes January 2016, entering into force 1 July 2016**

• Sec.4 Recycling - Recyclable
  — General: References are neutralized in the document and document numbers are only mentioned under "References".
  — [1.1, 1.4, 2.3.3, 3]: EU SRR is mentioned and explained.
  — Tables 4, 6 and 7: Revised for DocReq.
  — [2]: General update on Class Notation Recyclable.
  — [3]: New item inserted for EU SRR details.

**October 2015 edition**

This is a new document.
The rules enter into force 1 January 2016.
About DNV GL

DNV GL is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.